

xx June 2017

FOR APPROVAL OF PARA. 1

To: Takehiko Nakao, President

Through: Stephen Groff, Vice President (Operations 2)

From: Xianbin Yao, Director General, PARD

Subject: **Additional Financing — Proposed Administration of Strategic Climate Fund Grant for Papua New Guinea: Building Resilience to Climate Change in Papua New Guinea**

A. Recommendation

1. Pursuant to para. 52 of the Policy Paper on Enhancing Operational Efficiency of the Asian Development Bank (ADB), we seek your approval for the administration by the ADB of the grant not exceeding \$5 million to the Government of Papua New Guinea for the additional financing of the Building Resilience to Climate Change (BRCC) in Papua New Guinea (PNG) project, to be provided by the Strategic Climate Fund (SCF).

B. The Ongoing Project

2. ADB approved the grant 0447-PNG for \$24.25 million on 21 October 2015.¹ The grant became effective on 1 March 2016. The project comprises (i) climate change and vulnerability assessments carried out and adaptation plans developed for target communities; (ii) sustainable fishery ecosystems and food security investments piloted in nine vulnerable island and atoll communities; and (iii) enabling framework for climate-resilient infrastructure established and communications network extended. The executing agency is the Climate Change and Development Authority (CCDA), and the implementing agency is the Milne Bay Provincial Government (MBPG).

3. The report and recommendation of the President for the main BRCC project states that subject to additional funding from the Pilot Program for Climate Resilience (PPCR), a change in scope to output 3 will be made to include the upgrading of Alotau provincial government wharf in Milne Bay. The additional component to climate proof Alotau provincial wharf will serve as a pilot and demonstration climate adaptation model for climate proofing similar structures in PNG, thereby contributing and augmenting the output 3 to develop a climate-resilient framework for similar vulnerable structures in PNG, thereby strengthening the outcome of the main BRCC project on improved capacities of communities (in vulnerable atolls and islands), government agencies, and civil society to plan and respond to the impacts of climate change.

¹ ADB. 2015. *Report and Recommendation of the President to the Board of Directors: Proposed Administration of Grant to Papua New Guinea for Building Resilience to Climate Change in Papua New Guinea Project*. Manila.

4. In July 2015, the SCF-PPCR Sub-Committee endorsed the concept note for the allocation of an additional USD 5.0 million in PPCR grant resources to the project additional financing for BRCC in PNG to climate proof Alotau provincial wharf. In 10 April 2017, the government confirmed its request for additional financing to support climate proofing of the Alotau Provincial Wharf.

C. The Additional Financing

1. Rationale

5. The proposed additional financing will support an expansion of the scope of the BRCC and will increase project benefits. An existing design-life expired provincial wharf will be rebuilt with innovative climate adaptation features in the design and implementation of the project, with the additional financing from SCF. Climate resilient building codes and design standards will be developed based on the pilot climate proofing of Alotau Provincial Wharf. There is high demonstration potential in replicating the climate proofing design at Alotau wharf to other vulnerable coastal maritime infrastructure in PNG. The proposed project contributes to sustained access of outer island communities to basic needs post-disaster and extreme climate events. During normal operations, the wharf contributes to increased economic activities to support the livelihood and social needs of the communities, particularly women and children. Additional financing is considered appropriate because the additional component will augment the outputs of the original BRCC, and outcome statement by delivering additional and immediately tangible benefits to Milne Bay Province. The overall project remains technically feasible, and is accorded high priority by the government; and is consistent with the project's development objectives and the current ADB country partnership strategy.²

6. Regarding the performance of the ongoing project to date, consultant recruitment and procurement of goods (e.g. office equipment) was delayed due to capacity constraints in the CCDA. Although the project is currently assessed as an "actual problem", the project rating is expected to change to "potential problem" or "satisfactory" by December 2017 when at least one of the two major consultancy contracts will have been awarded.

2. Impact, Outcome, and Outputs

7. The impact will be increased resilience to the impacts of climate variability and climate change. The outcome will be improved capacities of communities (in vulnerable atolls and islands), government agencies, and civil society to plan and respond to the impacts of climate change. While the impact and outcome are unchanged, they will be enhanced through physical implementation of innovative climate change adaptation methods of climate proofing Alotau Provincial Wharf, which would have replication potential in other similar structures in PNG. The creation of new climate proofing design codes and standards for Alotau contribute directly to output 3 of the original project, which is to enabling framework for climate resilient infrastructure established and communications network extended.

3. Cofinancing

8. The total cost of the project, including the additional financing, is estimated to be \$32.93 million (Table 1). The \$5.0 million additional grant financing is proposed from SCF as a means to leverage ADB's leadership in supporting the implementation of climate change adaptation

² ADB. 2015. *Country Partnership Strategy: Papua New Guinea, 2016–2020*. Manila.

projects in PNG, to be administered by ADB. The additional financing will fund civil works for the replacement wharf and support the IA on project management, supervision and capacity building during implementation. The government has committed to counterpart financing is PGK2.0 million (approximately \$0.64 million) to finance 100% of the physical surveys and demolition costs. The revised investment and financing plans are in Tables 1 and 2.

Table 1: Revised Investment Plan (\$ million)

Item	Current Amount ^a	Additional Financing ^b	Total
A. Base Cost^c			
1. Climate change vulnerability assessment and adaptation plans	10.15	0.0	10.15
2. Sustainable fishery ecosystems and food security	7.52	0.0	7.52
3. Climate-resilient coastal infrastructure and early warning communications	7.18	0.0	7.18
3a. Climate-proofing Alotau Provincial Wharf		5.45	5.45
Subtotal (A)	24.85	5.45	30.30
B. Contingencies^d	2.44	0.19	2.63
Total (A+B+C)	27.29	5.64	32.93

^a Refers to the original amount and any previous additional financing.

^b Includes taxes and duties of \$76,000 to be financed from SCF grant financing. Such amount does not represent an excessive share of the project cost. The government is financing taxes and duties, amounting to \$53,820, for survey and demolition of the wharf. This will be provided from government counterpart funding.

^c In 2017 prices.

^d Pending completion of the detailed design of the Alotau Wharf project, the civil works cost component will be updated. There is currently \$2.44 million of unallocated funds in the main BRCC project, which is sufficient to cover additional taxes and duties, and physical contingencies that may be found to be required during the detailed design. Such funds could be reallocated if required, after approval of the proposed Additional Financing from SCF PPCR funds.

Source: Asian Development Bank estimates.

Table 2: Revised Financing Plan

Source	Current ^a		Additional Financing		Total	
	Amount (\$ million)	Share of Total (%)	Amount (\$ million)	Share of Total (%)	Amount (\$ million)	Share of Total (%)
Strategic Climate Fund (grant)	24.25	88.9	5.0	88.7	29.25	88.8
Beneficiaries	1.0	3.6	0.0	0.0	1.0	3.0
Government	2.04	7.5	0.64	11.3	2.68	8.2
Total	27.29	100.0	5.64	100.0	32.93	100.0

Note: Numbers may not sum precisely because of rounding.

^a Refers to the original amount and any previous additional financing.

Source: Asian Development Bank estimates.

4. Due Diligence

9. The additional financing component has been assessed as technically viable based on feasibility studies. The design includes full climate resilience for 50 years, including full climate proofing for 25 years and a simple means of extending climate proofing for another 25 years. Although the economic rate of return (EIRR) for the additional financing component is 9.2%, the economic is deemed very conservative, and since it does not include the unquantifiable benefits from climate change adaptation, increased accessibility for outer island communities for a basic needs during emergencies and post disaster, as well as a wide range of economic, social

functions during normal conditions. The EIRR for the overall project, including the main BRCC project, is 12.0%.

10. Following the Safeguard Policy Statement 2009 (SPS 2009), the screening of project location and proposed works concluded that the proposed project is category B for environment. An initial environmental examination has been prepared and appropriate institutional arrangements to ensure compliance with ADB's environmental safeguard requirements and government's environmental safeguards requirements are included in the project administration manual (PAM). The project is category C for both the involuntary resettlement and indigenous peoples following SPS. No resettlement and indigenous peoples impacts are anticipated. The proposed provincial wharf will be within the declared Ports Limits and within the state underwater lease owned by MBPG and the State of PNG. The due diligence confirmed there are no existing legacy land issues requiring corrective actions. No assets or business establishments will be affected on site. The rehabilitation of the wharf is not expected to have any adverse impact on, or target any, distinct or vulnerable ethnic or tribal group cultural sacred sites, endangered marine ecosystems and/or migrating fish species.

11. The project is categorized as having some gender elements. A gender action plan is not required but key gender features where feasible have been considered such as making provisions for future construction of access ramps, shelter and toilet facilities, which will be provided outside the current project as part of the upgrading of the Access Road and Wharf Entrance by MBPG. Deck lighting, pedestrian segregation, and hand rails, together with potable water supplies to the wharf for vessels and fire protection will be provided as part of the project. Women's participation in consultation meetings, and trainings and awareness on HIV/AIDS and safety measures will also be ensured during wharf construction and operation.

12. The procurement risk assessment concludes the procurement risk as high, mainly due to lack of experience in procuring and supervising projects of this scale and complexity, and lack of prior experience in implementing donor funded projects. Risk mitigation measures have been identified and described in the PAM (Appendix 3). Procurement support to the project implementation unit (PIU) in development of bid documents and tendering process will be provided from the main BRCC project.

13. The financial management assessment concludes the financial management risk as high. The key risks identified were the lack of experience in the management of projects of this value and financial sustainability of the project. A time-bound action plan has been developed in the PAM. The MBPG has submitted a proposal seeking provincial legislative approval to increase the tariffs to be imposed at the new wharf once completed. This will ensure financial sustainability to operate and maintain the facilities. The implementing agency is also committed to provide a full time Project Accountant to manage the financial aspects of the project, as well as a new Japan International Cooperation Agency grant to upgrade the Alotau market. Under the main BRCC project, two financial management consultants and one financial management officer have been recruited. The Financial Management Experts will provide on-the-job training to the Project Accountant to ensure the necessary internal controls and financial management systems are in place to account for project expenditures in accordance with ADB's requirements during project implementation. The first financial statement for the BRCC project has also been submitted to the Auditor General's Office for audit. Governance and integrity risks had been assessed in 2015 in the main BRCC project. The mitigating measures are still relevant, and are being implemented. The ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the government and MOF. The specific policy requirements and supplementary measures are described in the PAM.

5. Implementation Arrangements

14. CCDA, the executing agency for the main BRCC project, will act as the executing agency for the proposed project. MBPG, would be the implementing agency. A PIU is being established within MBPG. PNG Ports Corporation Limited (PNGPCL) is providing technical advisory support to the MBPG in reviewing detailed engineering design, procurement documents, and construction of the new wharf. An international expert will be engaged under the project to provide project management, supervision and capacity building (PMSC) to the PIU. Detailed design taking into consideration safeguard requirements and procurement support to the PIU will be funded from the main BRCC project.

15. MBPG shall provide counterpart funding for two surveys to be conducted by the detailed design consultants to inform detailed design, and for the civil works package to demolish the existing life expired wharf. The survey components will be procured using shopping method. Two civil works packages are anticipated, and will be procured using national competitive bidding in accordance with ADB's Procurement Guidelines (2015, as amended from time to time). The international consultant to provide PMSC to the PIU will be recruited using individual consultant selection, in accordance with ADB Guidelines on Use of Consultants (2013, as amended from time to time). The SCF will be disbursed in accordance with ADB's Loan Disbursement Handbook, and detailed arrangements agreed between the government and ADB.

16. The additional grant-financed outputs are expected to be completed by end 2019. The overall BRCC project is expected to be completed by 2021.

D. Staff Views

17. The proposed additional financing has been reviewed and supported by the Controller's Department, the Office of Cofinancing Operations, the Office of the General Counsel, and the Operations Services and Financial Management Department.

cc: Director General, PARD; Deputy Directors General, PARD; SDCC; Deputy General Counsel; Deputy Chief Economist and Deputy Director General, ERCD; Assistant General Counsel (K. Emzita); Assistant Controller (N. Wallace); Senior Director, SDSC; Directors, AIID; EREA; IED2; OCO; OSP2; PAUS; SDCC; SDES; Country Director, PNRM; O. Domagas, CTLA-LGD; C. Png; A. Syed, OGC; I. Caetani, OCO; C.J. Rhor, OSP2; T. Olofernes; D. Navarrete, SDES; S. Muramoto; N. Carandang; J. Williams; N. Salvador; PATE; PAU Head; Country Team Leader, PNRM; P. Curry; F. Asistin; C. Cruz; J. Gabriel, PAOD; Project file; eStar

Appendices:

1. Project at a Glance
2. Revised Design and Monitoring Framework
3. Project Administration Manual for Additional Financing component (including updated Procurement Plan)

Supplementary Appendices (available upon request):

1. Project Administration Manual for main BRCC project
2. Initial Environmental Examination for Additional Financing component
3. Summary Poverty Reduction and Social Strategy
4. Social Safeguards Due Diligence Report
5. Climate Risk and Vulnerability Assessment
6. PPCR grant application form, Annex 10
7. Economic Analysis

PROJECT AT A GLANCE

1. Basic Data		Project Number: 46495-003	
Project Name	Building Resilience to Climate Change in Papua New Guinea (additional financing)	Department /Division	PARD/PATE
Country Borrower	Papua New Guinea Government of Papua New Guinea	Executing Agency	Office of Climate Change and Development
2. Sector	Subsector(s)	ADB Financing (\$ million)	
		Total	0.00
3. Strategic Agenda		Climate Change Information	
Inclusive economic growth (IEG)	Pillar 2: Access to economic opportunities, including jobs, made more inclusive	Adaptation (\$ million)	6.12
Environmentally sustainable growth (ESG)	Global and regional transboundary environmental concerns	Climate Change impact on the Project	High
4. Drivers of Change		Gender Equity and Mainstreaming	
Governance and capacity development (GCD)	Institutional development	Some gender elements (SGE)	✓
Knowledge solutions (KNS)	Pilot-testing innovation and learning		
Partnerships (PAR)	International finance institutions (IFI) Official cofinancing		
5. Poverty and SDG Targeting		Location Impact	
Geographic Targeting	Yes	Not Applicable	
Household Targeting	No		
SDG Targeting	Yes		
SDG Goals	SDG8, SDG9		
6. Risk Categorization:	Low		
7. Safeguard Categorization	Environment: B Involuntary Resettlement: C Indigenous Peoples: C		
8. Financing			
Modality and Sources		Amount (\$ million)	
ADB		0.00	
Cofinancing		0.00	
None		0.00	
Counterpart		0.64	
Grant		0.64	
Total		0.64	

REVISED DESIGN AND MONITORING FRAMEWORK

Impact(s) the Project is Aligned with Current project The project impact is increased resilience to the impacts of climate variability and climate change. Overall project Unchanged.			
Results Chain	Performance Indicators with Target and Baselines	Data Sources and Reporting	Risks
Outcome Current project Improved capacities of communities (in vulnerable atolls and islands), government agencies, and civil society to plan and respond to the impacts of climate change	Current project By 2021 a. Gender responsive CCVAPs prepared under the project used in formulating LGL, district and provincial development plans for climate change adaptation b. 50% reduction in the incidence of waterborne and water-related diseases in target communities c. Fish populations increased by 20% in target LMMAs and food insecurity reduced by 20% from baseline figures d. Pilot marine ecosystem and food security approaches developed under the project applied in locations outside e. Early warning messages broadcast and emergency responses coordinated increased from 0 to 10 and 100 per year respectively in the coverage area by 2021 Overall project Unchanged.	a. KAP surveys of planning staff at respective levels compared to baseline b. Gender-disaggregated DOH database reports c. LMMA monitoring reports d. FDA annual work plans and budget requests: DAL annual work plans and budget requests e. NDC annual reports	Resources under the SGF will not be applied to the intended purpose Capacity building proposed in the design will not be extended to all intended beneficiaries/recipients
Overall project Unchanged.			
Outputs Current project Output 1	Current project By 2021		

Results Chain	Performance Indicators with Target and Baselines	Data Sources and Reporting	Risks
<p>Climate change and vulnerability assessments carried out and adaptation plans developed for target communities</p> <p>Output 2</p> <p>Sustainable fishery ecosystems and food security investments piloted in nine vulnerable island and atoll communities</p>	<p>1a. 21 vulnerable island communities with CCVAP, climate resilient development plans incorporated into LLG, district and provincial plans</p> <p>1b. Gender responsive disaster response strategies developed in 21 vulnerable island communities</p> <p>1c. Provincial (50) and NGOs (50) staff (30% being women) trained in adaptation to climate change</p> <p>Current project</p> <p>2a. Nine LMMAs established, registered and operational with approved management plans being implemented</p> <p>2b. Adaptation measures against climate change in home gardens demonstrated in nine target communities</p> <p>2c. Nine mangrove forest rehabilitation demonstrated</p> <p>2d. Three watershed rehabilitation demonstrated in communities adjoining target vulnerable islands</p> <p>2e. Food processing and preservation initiatives piloted in nine island communities (50% women)</p> <p>Current project</p>	<p>1a. Provincial development plans in provincial administrator's office</p> <p>1b. NDC disaster reports</p> <p>1c. PMR and training evaluation reports.</p> <p>2a–e. PMR reports</p>	<p>Capacities of provincial staff prevent the program from being properly implemented</p> <p>Sanitation facilities are not a priority for local communities</p> <p>Motivation of provincial staff is low because resources are channeled through NGOs</p> <p>Capacities of villagers to participate in marketing and food processing initiatives</p>
<p>Output 3</p> <p>Enabling framework for climate resilient infrastructure established and communications network extended</p>	<p>By 2021</p> <p>3a. Upgraded engineering design standards for coastal structures used in port, wharf and jetty design</p> <p>3b. Building codes and design standards upgraded to incorporate climate change considerations</p>	<p>3a. KAP surveys of design engineers (both government and private) c.f. baseline</p> <p>3b. Confirmation by professional institution</p>	<p>Tower owners will not allow the project to access the towers for installation of equipment</p> <p>Counterpart funding will not be allocated to</p>

Results Chain	Performance Indicators with Target and Baselines	Data Sources and Reporting	Risks
<p>Overall project</p> <p>Unchanged.</p>	<p>3c. Climate risk management policy developed and adopted by PNGPCL</p> <p>3d. PNGPCL, national and provincial staff (30% being women) trained in the incorporation of risks from climate change in coastal port/jetty operations</p> <p>3e. By 2018, five VHF repeater stations established on existing towers and receiving substations established in 21 target islands</p> <p>3f. By 2016, PMU established, staffed and equipped and monitoring systems developed.</p> <p>3g. By 2016, project activities and performance posted on project website</p> <p>Overall project (Additional Financing)</p> <p>3h. Demonstration project for climate proofing Alotau Provincial Wharf completed by December 2019</p>	<p>3c. National policy statement prepared</p> <p>3d. PMR and training evaluation reports</p> <p>3e–f. PMR reports</p> <p>3g. Website inspection</p> <p>3h. PMR reports</p>	<p>allow the PMU to operate efficiently</p>

Key Activities with Milestones

1. Climate change vulnerability assessments carried out and adaptation plans developed for target communities.
 - 1.1 Prepare localized projections of climate change in 21 target islands by Q1 2017.
 - 1.2 Undertake CCVAP mapping in 21 vulnerable islands by Q1 2017.
 - 1.3 Develop CCVAP for endorsement of the community and integration into the district development plans by Q2 in 2017
 - 1.4 Establish SGF to finance investments identified during CCVAP by Q3 2017.
 - 1.5 Supply and install 200 water supply and 100 sanitation facilities in target islands by Q4 2018.
 - 1.6 Develop emergency response strategies and train inhabitants of target islands by Q4 2018.

Key Activities with Milestones

2. Sustainable fishery ecosystems and food security investments piloted in nine vulnerable island and atoll communities.
- 2.1 Sustain the integrity of fishery ecosystems by piloting a ridge to reef approach in target communities by Q4 2019.
- 2.2 Pilot food security initiatives (production, processing and storage) in target locations by Q4 2019.
- 2.3 Provide NGO support to facilitate delivery of fisheries ecosystems and food security initiatives and build capacities of communities and provincial/district staff by Q2 2017.
3. Enabling framework for climate resilient infrastructure established and communications network extended.
- 3.1 Support policy dialogue for the design and maintenance of port infrastructure by end 2018.
- 3.2 Revise appropriate engineering standards to accommodate the impact of climate change in infrastructure design by end 2018.
- 3.3 Build capacities of national and provincial port and wharf design specialists to incorporate economic returns achieved from incorporating climate resilience in feasibility studies by end 2019.
- 3.4 Develop options for the sustainable financing of port rehabilitation and upgrading taking into account climate change by end 2018.
- 3.5 Expand communications network in five provinces through radio repeater stations and island receivers by Q4 2017.
- 3.6 Train CCDA staff in procurement, financial management, and implementation coordination, among others.
- 3.7 Maintain the project performance and management systems designed by the PISC throughout implementation.
- 3.8 (i) Engage detailed design and construction supervision consultants for Alotau wharf by Q4 of 2017. Bidding documents for civil works package completed by Q1 of 2018, and awarded by Q1 of 2019. (New) 3.8 (ii) Bidding documents for construction contract for Alotau wharf completed by Q2 of 2018. Civil works for construction contract awarded by Q1 of 2019 (New).

Project Management Activities

Establish PMU, appoint incremental staff, second government employees to the PMU by end 2016.

Train CCDA staff in procurement, financial management, and implementation coordination, among others. Recruit implementation support consultants by Q4 2016.

Establish project performance and financial management systems for project and SGF by Q4 2016. Complete monthly, quarterly, and annual progress and financial reporting to the Government and ADB ongoing.

Participate in Midterm by end 2018 and Project Completion Reviews by end 2021.

Establish dedicated PMU within MBPA by end of Q 2017

Inputs

SCF Grant	Government
\$24.25 (current)	\$3.04 (current)
\$5.00 (additional)	\$0.64 (additional)
\$29.25 (overall)	\$3.34 (overall)

Assumptions for Partner Financing**Current project**

Not applicable.

Overall project

Unchanged.

CCDA = Climate Change and Development Authority; CFDA = Coastal and Inland Fisheries Development Agency; CIF = Climate Investment Fund; CCVAP = Climate Change Vulnerability Adaptation Plans; DAL = Department of Agriculture and Livestock; DOH = Department of Health; KAP = knowledge attitude and practice; LLG = local level government; LMMA = local marine management association; MBPA = Milne Bay Project Administration; NDC = National Disaster Center; NGO = nongovernment organization; PISC = Project Implementation Support Consultant; PMR = project monitoring reports, PMU = project management unit; PNGPCL = Papua New Guinea Ports Corporation Ltd.; PPCR = Pilot Program for Climate Resilience; Q = quarter; SGF = Small Grants Facility; VHF = very high frequency.

Source: Asian Development Bank.

ECONOMIC ANALYSIS

A. Introduction

1. This analysis evaluates the costs and benefits of the proposed project, which will provide a replacement, with climate-proofing features, of an important maritime facility. Economic benefits are expected from the continued use of the wharf both in normal times, and during and after extreme weather events, thereby ensuring sustained and continued socioeconomic growth in the outer islands.

2. Papua New Guinea (PNG), the largest among Asian Development Bank's (ADB) Pacific developing member countries, experienced relatively strong growth in real gross domestic product (GDP) in recent years. However, falling commodity prices and government expenditure cutbacks caused growth to drop to 2.0% in 2016 from 12.0% in 2015. This is projected to recover somewhat to 2.5% in 2017 and 2.8% in 2018.¹ Population in Milne Bay province is growing at over 3.0% per annum, faster than annual national population growth at 2.0%.

3. In Sanderson Bay, the Milne Bay Provincial Government (MBPG) is responsible for two small adjacent marine facilities: (i) this project's subject Provincial Wharf, 36 meters (m) long; and (ii) the interdependent Provincial Jetty, about 40 m long. In 2016, the wharf handled 126 vessels and the jetty 1,724 vessels. The wharf can handle three larger vessels (20m–25m long) simultaneously, and occasionally very small vessels (e.g., police boats) on the landward side. Moored end-on, the jetty can handle about 15 smaller vessels (>8m) at a time and operates at full capacity on normal weekdays. These facilities are vulnerable to the adverse effects of climate change, especially sea level rise and increasingly intensive storm surges.

4. The wharf and jetty serve almost all provincial interisland traffic, and outer island communities depend on these for access to essential services and for business activities in Alotau, Milne Bay's provincial capital. Cargoes from the islands to Alotau are mainly agricultural produce. From Alotau to the islands, cargo comprises food, rice, and consumer goods; and intermediate inputs such as fuel and building materials; as well as sundry items and some live animals. All cargo is manually unloaded from or loaded onto vessels. By virtue of a 2009 MBPG decision, a berthing fee of K1.00/m/h is applied to vessels 10m or longer at the wharf, but this is not currently collected at the jetty. Charges of K5.00/person for passengers, and K5.00/m³ or ton for cargo, are currently not collected at the wharf or the jetty.

B. Cost-benefit Analysis

5. The costs and benefits of the project are compared with a "without-project scenario" wherein the existing wharf, due to its highly deteriorated condition, is simply demolished. An inspection in January 2017 revealed that its concrete deck was damaged and past its useful life. Further, the supporting steel beams are severely corroded and the design of the interfaces does not meet current standards, posing significant risks to current operations and ruling out refurbishment as a viable option. Demolition costs are the same under both scenarios, at \$324,900 in economic terms using a 0.95 standard conversion factor² (SCF) on the entire amount.

6. Under the without-project scenario, wharf vessels would need to berth alongside at an already congested jetty operating at maximum capacity. Two 20m vessels berthed alongside

¹ ADB. 2017. *Asian Development Outlook 2017*. Manila.

² ADB. 2015. *Report and Recommendation of the President to the Board of Directors: Proposed Administration of Grant for Building Resilience to Climate Change in Papua New Guinea Project*. Manila. As advised, this SCF is used throughout this analysis and is applied to both costs and benefits.

would fill the jetty and crowd out all other existing users, heavily disrupting activity at the jetty and in Sanderson Bay generally. Vessels would thus incur higher fuel and crew costs due to increased congestion at the jetty and moorings. During the time spent in Sanderson Bay, these would have to travel back and forth from other moorings/anchorages several times. Boat owners would be forced to stay for shorter times, and moor elsewhere after unloading and before returning to load.

7. There would also be increased difficulty for loading and unloading by larger vessels berthed side-on, as opposed to the smaller vessels that can berth end-on. (Berthing end-on is not ideal, even for small vessels, as all cargoes would need to be manually hauled on and off the stern of the vessels.) This increases the risk of damage to cargo. Perishable cargo such as agricultural produce also runs the risk of spoilage due to longer waiting times.

8. Further, there will not be any climate-proofed facilities under the without-project scenario. This would result in unquantifiable adverse impacts in the event of disasters or extreme climatic conditions. The wharf has played an important role in distributing emergency supplies via the larger passenger-cargo vessels, in the aftermath of extreme climate events. Without this wharf, the local population—especially in outer island communities with higher poverty levels—will be unable to secure their basic food and fuel needs, and become more vulnerable as extreme weather events occur more frequently.

9. The proposed project, selected from a number of technical options considered, involves demolition of the existing wharf and replacement with a new wharf in approximately the same position, with climate-proofing features. There is scope for adding a rear berth (or berths) later when funding permits. Investment cost is estimated at \$4.7 million in economic terms, net of taxes, duties, and the demolition cost described in para. 5, and using the SCF on the domestic cost component (estimated by project engineers at 70% of the total). The wharf is expected to commence operations in the last quarter of 2018. At the end of 30 years, it is estimated to have a residual value of \$2.0 million based on straight-line depreciation.

10. Operations and maintenance costs are estimated at \$28,320 a year (in economic terms) in 2017 prices for the first 4 years of the project, and \$37,895 from Year 5 onwards.³ Recurrent costs also include \$120,625 a year (in economic terms, with the SCF applied to the 70% domestic cost component) for project management, supervision, and capacity building, during the first 2 years of the project.

11. The “with-project scenario” assumes that 20% of the 1,724 vessels that used the jetty in 2016 (or 345 vessels) will prefer to use the new wharf. Data on traffic between Alotau and the islands of Milne Bay is limited and shows no clear trends, so incremental traffic to the wharf is conservatively projected, based on population and GDP trends, to increase by 2% per annum between 2016 and 2035. On average, each vessel berthing at the wharf is 12m long, spends 22 hours at berth, and carries 15 tons of cargo (inward and outward) and 20 passengers.

12. MBPG plans to implement changes to its tariff structure upon completion of the proposed project. Namely, it will increase the berthing fee to K2.00/m/h, and fully implement the passenger and cargo charges. The resulting revenues, expected to be used for operations and maintenance, will be crucial for ensuring sustainability of the new facility. However, since all vessels expected to call at the wharf would be domestic, revenues from these tariffs are treated as transfers and thus excluded from this economic analysis.

³ From GHD Consultants on 23 March 2017 and based on the operation and maintenance for first ten years of the project. The 0.95 SCF was used on the entire amount.

13. This scenario also assumes that both jetty and wharf users would save time and fuel due to more efficient berthing/unberthing. Each vessel stands to save a total (upon both entry and exit of the provincial facilities) of 8 additional liters (L) of fuel and 8 hours (h) per crew member. Fuel cost is estimated at \$0.94/L, and time savings are based on the minimum wage of \$0.96/h (both in economic terms) and an average crew of 4 persons.⁴

14. Further, adequate facility space would allow for safer handling and, together with the shorter waiting times, reduce the risk of damaged/spoiled cargo in both the wharf and jetty. Although average cargo is assumed at only 5.7 tons per vessel, inward and outward, to account for smaller vessels at the jetty, the estimated value of \$4,750/ton⁵ in economic terms is such that a damage rate of 0.5% of the value would still result in significant benefits under the project.

15. Finally, passengers of vessels berthing at both the jetty and the wharf are expected to save time due to alleviation of congestion at the jetty. The value of passenger time savings is calculated as 1 hour, worth \$3/h in economic terms, per passenger, multiplied by the average number of passengers (20 aboard each vessel at the wharf, and 10 aboard each vessel at the jetty) and number of vessels. Although the resulting revenue stream is the smallest among those estimated in this economic analysis, this is still significant especially if one considers that many of these passengers are residents of the outer island communities who are benefiting from improved access to social services and economic opportunities.

16. Under the foregoing parameters and using a discount rate of 9.0%, the project has an economic internal rate of return (EIRR) of 9.2% and economic net present value (ENPV) of \$72,405. The economic analysis is deemed very conservative as it excludes the unquantified benefits from climate change adaptation and outer island communities' increased access to basic needs during emergencies. Further, the analysis does not consider the benefits of a wide range of economic and social functions under normal conditions, including potential growth in tourism to the area. The overall climate resilience project, with the additional financing component, has an EIRR of 12.0% and ENPV of \$5.3 million.

C. Sensitivity Analyses

17. The project loses economic viability in the face of adverse changes to the costs and benefits (Table 1). It appears more sensitive to changes, particularly delays, in benefits. Due to exclusion of tariff revenues, this sensitivity analysis does not examine the impact of various tariff regimes.

Table 1: Results of sensitivity analysis

⁴ Based on on-site research and discussions with boat owners. Manual loading and relatively long sailings of 1-2 days entail crews often up to 5 people.

⁵ The value of cargo is relatively high; a consignment of fuel could have a value of well over K20,000 and 10 cubic metres of food items could be worth K30,000.

Scenario	EIRR	ENPV	Switching value
Base case	9.2%	\$72,405.4	
(i) 10% increase in investment costs	8.2%	-\$363,084.1	1.7%
(ii) 10% increase in total costs	8.1%	-\$404,843.0	1.5%
(iii) 10% decrease in total benefits	8.0%	-\$412,083.5	-1.5%
(iv) Scenarios (ii) and (iii) combined	7.0%	-\$889,331.9	
(v) 1 year delay in benefits	6.7%	-\$954,299.4	
(vi) Scenarios (ii), (iii), and (v) combined	5.0%	-\$1.8 million	
(vii) Only 10% of vessels transfer to the wharf	8.1%	-\$376,836.9	18.4%

EIRR=economic internal rate of return, ENPV=economic net present value.
Source: Asian Development Bank estimates.

Table 2: Updated cost-benefit analysis for overall PNG climate resilience project (in thousand US dollars)

Year	Costs							Benefits							Net Benefits
	Investment			Recurrent			Total Costs	Original			Additional			Total Benefits	
	Original	Additional	Subtotal	Original	Additional	Subtotal		Output 1	Output 2	Output 3	Cost savings	Averted cargo damage	Passenger time savings		
2016	1,060.0	-	1,060.0	-	-	-	1,060.0	-	-	-	-	-	-	-	(1,060.0)
2017	5,070.0	-	5,070.0	-	-	-	5,070.0	659.7	103.7	-	-	-	-	763.4	(4,306.6)
2018	7,220.0	4,746.8	11,966.8	-	148.9	148.9	12,115.8	732.8	231.9	191.3	74.0	261.2	64.4	1,555.8	(10,560.0)
2019	5,318.4	-	5,318.4	-	148.9	148.9	5,467.3	751.0	469.9	335.2	83.9	296.1	79.9	2,016.0	(3,451.3)
2020	3,660.0	-	3,660.0	125.0	28.3	153.3	3,813.3	769.7	747.2	394.1	84.3	297.4	80.4	2,373.2	(1,440.1)
2021	2,230.2	-	2,230.2	125.0	28.3	153.3	2,383.5	788.9	1,049.0	401.5	84.7	298.7	81.0	2,703.8	320.3
2022	-	-	-	125.0	37.9	162.9	162.9	808.6	1,281.2	409.1	85.0	300.0	81.6	2,965.5	2,802.6
2023	-	-	-	125.0	37.9	162.9	162.9	828.6	1,510.9	416.8	85.4	301.4	82.2	3,225.2	3,062.4
2024	-	-	-	125.0	37.9	162.9	162.9	849.3	1,774.5	424.6	85.8	302.7	82.8	3,519.8	3,356.9
2025	-	-	-	125.0	37.9	162.9	162.9	870.3	1,984.3	432.6	86.2	304.1	83.4	3,761.0	3,598.1
2026	-	-	-	125.0	37.9	162.9	162.9	892.2	2,270.8	440.8	86.6	305.6	84.1	4,080.0	3,917.1
2027	-	-	-	125.0	37.9	162.9	162.9	914.5	2,546.8	449.1	87.0	307.0	84.7	4,389.2	4,226.3
2028	-	-	-	125.0	37.9	162.9	162.9	937.2	2,812.8	457.6	87.4	308.5	85.4	4,689.0	4,526.1
2029	-	-	-	125.0	37.9	162.9	162.9	960.6	3,069.3	466.3	87.9	310.0	86.1	4,980.1	4,817.2
2030	-	-	-	125.0	37.9	162.9	162.9	984.6	3,316.4	475.1	88.3	311.6	86.8	5,262.8	5,099.9
2031	-	-	-	125.0	37.9	162.9	162.9	1,009.0	3,554.7	484.1	88.8	313.2	87.5	5,537.2	5,374.3
2032	-	-	-	125.0	37.9	162.9	162.9	1,034.3	3,784.5	493.2	89.2	314.8	88.2	5,804.2	5,641.3
2033	-	-	-	125.0	37.9	162.9	162.9	1,060.3	4,006.0	502.6	89.7	316.4	88.9	6,063.9	5,901.0
2034	-	-	-	125.0	37.9	162.9	162.9	1,086.7	4,219.7	512.1	90.2	318.1	89.6	6,316.4	6,153.5
2035	-	-	-	125.0	37.9	162.9	162.9	1,113.7	4,425.8	521.8	90.6	319.8	90.4	6,562.2	6,399.3
2036	-	-	-	125.0	37.9	162.9	162.9	157.6	4,624.6	531.7	90.6	319.8	90.4	5,814.7	5,651.8
2037	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2038	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2039	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2040	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2041	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2042	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2043	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2044	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2045	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2046	-	-	-	-	37.9	37.9	37.9	-	-	-	90.6	319.8	90.4	500.9	463.0
2047	-	(2,028.7)	(2,028.7)	-	37.9	37.9	(1,990.8)	-	-	-	90.6	319.8	90.4	500.9	2,491.7
EIRR														12.0%	
ENPV @ 9%														\$5,348.98	

Sources: ADB estimates and consultants' due diligence report.