



Pacific Region
Infrastructure Facility



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

SGC Smith Geoscience Consultancy

28 May 2024

Responsible Sourcing of Aggregates in the Pacific

Professor Daniel Franks, Dr Paul Rogers,
Bora Aska, Dr Patrick Junior, UQ

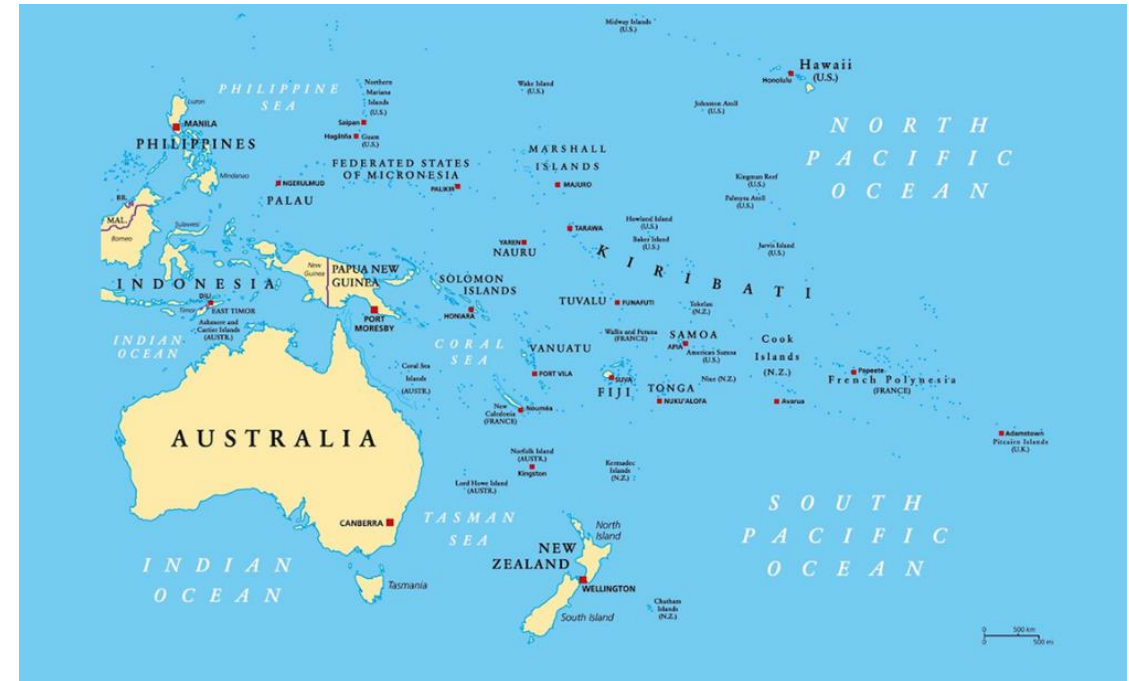
Mr Robert Smith, Smith Geoscience
Consulting

Gary Lee, Pacific Community

Raymond Mohammed, Fiji Mineral
Resources Department

Rationale - the challenge of responsible aggregate sourcing in the Pacific

- ADB estimates that Pacific Island Countries need \$30 billion in infrastructure investment by 2030
- Aggregate - Sand, gravel and crushed rock – are indispensable for concrete production, road base, road surfacing and land reclamation
- Sourcing affordable, quality aggregate of the right type has been a major challenge for infrastructure developers in recent years
- Challenges include:
 - Delays to infrastructure projects
 - High material and shipping costs
 - Port facilities
 - Lack of testing facilities to determine quality aggregate
 - Adverse impacts on infrastructure caused by poor quality
 - Significant environmental and social impacts from extraction



Aim and objectives



Aim

- Support identification of, and transition to, sustainable and resilient sources of quality, cost effective aggregates across PRIF member countries in the Pacific to meet growing demand from the infrastructure sector



Clearing a boat channel in the Betio Bariki causeway of sand, Kiribati (photo: Peter Oliver)

Objectives

1. Develop a knowledge base of the aggregates sector focusing on the 14 PRIF member countries
2. Review experience of aggregates sourcing by infrastructure developers in the region
3. Identify fundamental issues, including challenges, associated with sourcing aggregates by infrastructure developers
4. Identify, document and assess alternative materials and their potential to be used in infrastructure projects
5. Assess options to improve the quality and adequacy of supply of aggregates
6. Develop recommendations and best practices to provide input for any future development of safeguards to improve the responsible sourcing of aggregates for key stakeholders

Findings



Assessment of aggregate self-sufficiency

- Countries have varying levels of self-sufficiency in meeting aggregate demands for infrastructure due to diverse geological resources, geographic isolation, fragile environments and financial resources available to develop an aggregate extraction industry

Country	Expected aggregate demand	Mineral security
Cook Islands	High	Medium
FSM	High	Low-medium
Fiji	Very high	High
Kiribati	High	Low
Nauru	Low	Medium to High
Niue	Medium	Low-medium
Palau	Low to medium	Low to medium
PNG	Very high	TBC
RMI	Low-medium	Low
Samoa	Medium-High (TBC)	Medium
Solomon Islands	High	Low-medium
Tonga	Medium	Low-medium
Tuvalu	Medium	Low
Vanuatu	Medium to High	Low-medium



River gravel extraction, Ngalimbiu River, Solomon Islands (photo: Daniel Franks, 2023)

Findings

Regional Trade and Supply Chains

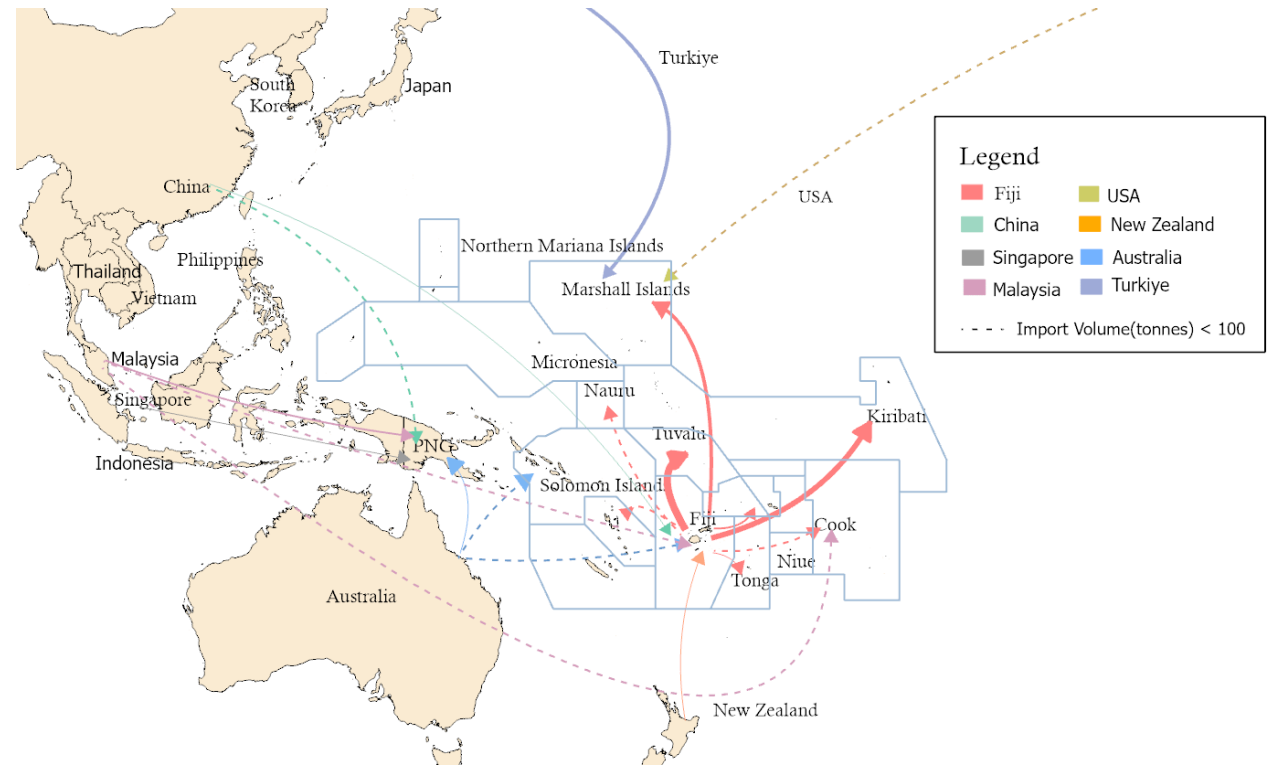
- Fiji is the main supplier of aggregates to other countries in the region (~79% of the region's imports), with Kiribati, Tuvalu and the Marshall Islands being the biggest consumers of materials.
- Aggregate also imported from Australia, New Zealand, China, and even as far away as Türkiye and Norway.



Barge carrying aggregate off Suva, Fiji (photo: Robert Smith, 2022)



Aggregate Regional Trade Pacific Island Countries (2020-2022)



Findings

Environment and Social Issues

- River gravel extraction and coral mining presents serious environmental, social and reputational risks across the region.
- Atoll countries have been especially impacted by unsustainable sand and coral mining over several decades, however, there are bright spots such as ESAT in Kiribati and TCAP in Kiribati and Tuvalu.
- Beach sand mining continues even after prohibition, e.g., Tonga.
- Quarries offer the most responsible and sustainable source of quality aggregate for the region, though with some risks e.g., groundwater impacts in Tonga.



Top: Reef aggregate extraction. Bottom: Armour rock coastal protection. Marshall Islands (photos: Robert Smith)



Findings



OHS and Landowner Issues

- There have been a numerous safety incidents in quarries across the region in recent years, both fatalities and injuries (e.g., 286 OHS incidents in Fiji 2007-2017).
- Many Pacific Island Countries do not have official reporting of safety incidents, or even formal collection of data
- Land access remains the most challenging issue in hard (and soft) rock quarry operations in many PICs
- In Fiji, hard rock quarries have better community relations with the landowners due to long-term nature of the quarries and contributions such as royalty revenues, employment opportunities and improvement of infrastructure



Coastal protection, Solomon Islands (photo: Daniel Franks, 2023)

Findings



Alternative Sources

- Several promising alternative sources of aggregate in the region, including:
 - Nauru’s dolomite resources (and possibly those on Kiribati’s Banaba Island)
 - Ferro nickel slag, or “Le Sland”, a by-product of nickel refining in New Caledonia (a stockpile of 25 million tonnes is currently not being used and a further 1 million tonnes is added each year)
 - Ore-sand from some of the region’s existing and upcoming metallic mines, such as in Fiji and the Solomon Islands.

Top: Dolomite pinnacles, Nauru (photo: Peter Oliver, 2019). Bottom: Le Sland, New Caledonia (photo: SLN)



Recommendations



Good Practice Principles of Responsible Sourcing

- Principles for river extraction
 - Principles for sand mining and lagoon dredging (in atoll settings)
 - Principles for hard and soft rock quarrying
 - Specific guidance for government
-
- Refine and further develop principles
 - Conduct regional workshops
 - Develop implementation guidance



Washing of crushed limestone aggregate, Efate, Vanuatu (photo: Paul Rogers, 2023)

Recommendations

Strengthening supply

- Evaluate the feasibility of establishing projects like ESAT and TCAP in other PICs
- Provide support for surveys in countries where there is limited knowledge of aggregate resources
- Countries to establish centralized databases of quarries and other extraction sites, including developing a comprehensive GIS database
- Provide support for necessary facilities and expertise to test aggregates for quality
- Ensure good practice community engagement to avoid landowner disputes over land access, royalties and other issues limiting potential quarry operations



Seawall in Ebey, RMI, built from local coral rubble by the Japanese circa 1940 (photo Gary Lee, 2023)

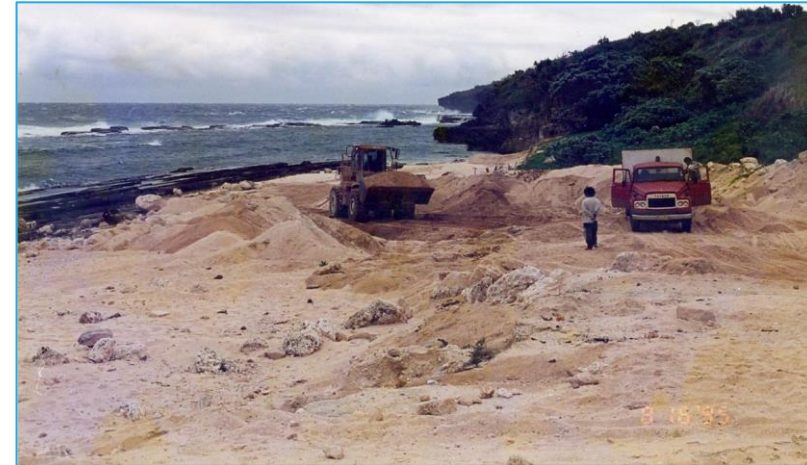
Recommendations

Capacity building

- Conduct training in good quarry management practice and related skills (e.g., OHS, explosives handling and use etc.)
- Provide relevant government agencies with the resources and skills to monitor and enforce compliance with environmental regulations
- Each country should develop and make publicly available a Quarry Management Guide



Top: Beach sand mining, Tonga (photo: Robert Smith, 1995). Bottom: Aggregate quarry, Samoa (photo: Daniel Franks, 2023)



Recommendations



Alternative sources

- In Nauru, the government with the support of international donors should provide financial and technical support to the nascent dolomite quarry industry
- Take initial steps to explore the potential of creating a limestone / dolomite export industry in Banaba, Kiribati
- Commence engagement with metal miners in Fiji and the Solomon Islands to explore interest in producing ore-sand
- Undertake a market study to determine regional interest in using New Caledonia's ferro-nickel slag, as an aggregate in the region

Tuvalu Coastal Adaptation Project, Fogafole
(photo: James Lewis)





Pacific Region Infrastructure Facility

theprif.org