Just Transitions and the Pacific

Pacific energy transition-extractives nexus integrated dataset

Methodology and summary briefing note

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Version 1

This note constitutes an output from the Just Transitions and the Pacific project, a collaboration between the University of St Andrews' Centre for Energy Ethics, and the University of Queensland's Centre for Social Responsibility in Mining (CSRM), in the Sustainable Minerals Institute.

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Work Package 1: develop an integrated dataset that maps the energy transition-extractives nexus across the Pacific.

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1. Introduction

This briefing note summarises the Pacific energy transition-extractives nexus dataset[1] produced as part of the Just Transitions and the Pacific project.

This dataset is a first-of-a-kind that maps energy transition resources and mining concessions in the Pacific Islands region against composite environmental, social and governance (ESG) indicators.

This dataset provides the basis to identify and understand the broader justice issues that co-occur with specific energy transition ore bodies, and to map potential justice risks that will accompany future extractive activities in the Pacific.

The purpose of this note is to (1) explain the methodology for the dataset; (2) summarize results; and (3) offer a preliminary discussion of the findings.

2. Methodology

This dataset was compiled using the methodology developed by Lèbre et al. (2020) for analysing at the global scale the situated ESG risks for mining projects extracting energy transition ore bodies. We applied this methodology at a regional scale to consider the level of exposure to situated ESG risks for mining projects extracting energy transition ore bodies in the Pacific. We then compare Pacific-level data with global trends.

2.1 Analytical framework

This analysis uses the concept of situated risks to consider the energy transition-extractives nexus in the Pacific – i.e. that ESG risks are partly defined by the context in which mining takes place (Lèbre et al., 2019), and that pre-existing risk factors in mining locations create specific conditions for the mine developer whose practices in turn drive risk up or down. The concept of situated ESG risks has been applied, and methodologies developed on this basis, in several studies (e.g. Northey et al., 2017, Luckeneder et al., 2021, Sonter et al., 2020). The analysis presented here is based on methodology developed by Lèbre et al. (2020), which applies a set of global spatial data sets as proxies for ESG risk factors relevant to mining development. Geo-localised mining projects are overlaid with ESG spatial data to assess the level and type of risk these projects are exposed to.

Lèbre et al. (2020) provide a set of 24 spatial indicators aggregated into seven ESG risk dimensions: 'Biodiversity', 'Water', 'Waste', 'Communities', 'Land Uses', 'Social Vulnerability' and 'Governance'. The three environmental dimensions ('Biodiversity', 'Water' and 'Waste') cover the proximity of mining projects to key biodiversity conservation areas, risks related to the availability and quality of fresh water resources in the region, and the possibility of extreme climatic or seismic events, that may trigger mine waste containment breaches. The three social dimensions ('Communities', 'Land Uses' and 'Social Vulnerability') include communities in proximity to the project, the existence of competing land uses, and social vulnerability metrics in the region. The 'Governance' risk dimension aggregates several indicators measuring levels of corruption, freedom, rule of law, political stability, and the quality of regulations and public services.

Table 1 presents each ESG risk category in detail and explains their relevance to the study of mining developments' effects on the host environment.

[1] See accompanying MS Excel sheet (WP1_Pacific_ETMdataset_final_v1).

ESG dimension	ESG risk category	Description and relevance to the study
Environment	Extreme events	Extreme weather and seismic events can compromise the integrity of mining voids and mine waste facilities. Failure to contain mining waste has consequences with severity varying between chronic toxic seepage to catastrophic tailings dam failures. These risks often remain after mine closure.
	Water	Mining operations have high freshwater requirements and compete with other water users in places where water is scarce. Too much water is also a challenge for miners as uncontrolled water flows come in contact with reactive minerals and generate toxic seepage.
	Conservation	Mining activities involve deep land transformation and other impacts (e.g. noise and vibration) that directly impact local ecosystems. This risk category considers the proximity of mining projects to key biodiversity and conservation areas.
Social	Land Uses	Mining activities require access to and acquisition of land and compete with pre-existing land uses including agriculture, and subsistence livelihoods that depend on the forest.
	Communities	Mining activities affect communities living in the direct proximity of the project, with economic and physical resettlement taking place as well as influx of people attracted to economic opportunities. Changes affect communities from early exploration stages to post-closure. Communities living in the wider area of economic influence around the project can also be indirectly affected by either chronic or catastrophic impacts. This category also includes the project’s proximity to Indigenous land as Indigenous Peoples generally experience higher levels of vulnerability to mining development.
	Social Vulnerability	Pre-existing factors of vulnerability influence the ability of local communities and the wider society to cope with mining-induced impacts. This category encompasses metrics on socio-economic inequalities at national scale, age dependency (reflective of economic pressures at household level) and human development (covering measures of health, education and income).
Governance	Governance	A robust governance system ensures mining revenues are distributed fairly, and that citizens are protected against adverse impacts, whereas a poor governance system creates a permissive environment for suboptimal industrial practices.

Table 1 ESG risk categories

2.2 Selection of mining projects

The dataset uses those indicators to develop situated ESG risk profiles for select mining projects across all development stages in the Pacific. Table 2 outlines the mining project development stages and data categories.

Development stage – simple categorisation	Development stage
Early stage	- Grassroots - Exploration - Advanced exploration - Target outline - Reserves development - Prefeasibility / Scoping - Feasibility
Preproduction	- Construction - Commissioning
Operating	- Operating - Expansion - Satellite - Limited / Residual production
Closed	- Closed

Table 2 Mining project stages and data categories

Mining project data was sourced from the S&P Capital IQ Pro database. The S&P database is one of the most comprehensive and up-to-date sources of mining data. As of November 2021, it maintains records on 36,395 geolocated mining projects worldwide at all development stages, from grassroot exploration to closure.

From the S&P database, we selected projects extracting or projecting to extract so-called 'energy transition minerals and metals' (ETMs), i.e. minerals and metals that are components of low-carbon energy technologies or that are needed in low-carbon energy generation, storage and transport infrastructure. ETM lists were consolidated from reports from the International Energy Agency (IEA, 2021), the World Bank (Hund et al., 2020), and the International Institute for Sustainable Development (Church and Crawford, 2018). We arrived at a list of 29 ETMs in total (see Box 1).

Box 1 Consolidated ETM List

- Bauxite (Aluminium)
- Chromium
- Cobalt
- Copper
- Gallium
- Germanium
- Graphite
- Indium
- Iridium
- Iron Ore
- Lead
- Lithium
- Magnesium
- Manganese
- Molybdenum
- Nickel
- Niobium
- Platinum
- Rare earth elements
- Selenium
- Silver
- Tantalum
- Tellurium
- Tin
- Titanium
- Tungsten
- Vanadium
- Zinc
- Zircon

The S&P Capital IQ Pro database includes information about a total of 161 ETM mining projects in the Pacific, at various stages of development. These are located in seven Pacific countries (see Table 3). To test the exposure of Pacific projects to situated ESG risks compared to projects in the rest of the world in this analysis we compared these projects with a set of 5,097 ETM mining projects worldwide.

Countries included in the scope of the study	Number of ETM mining projects in database
Fiji	21
Indonesia (Papua and West Papua)	18
New Caledonia	19
Papua New Guinea	87
Solomon Islands	12
Tonga*	2

Vanuatu	2
Niue	*0*
French Polynesia	*0*
*Cook Islands***	*0*
Kiribati	*0*
Marshall Islands	*0*
Nauru	*0*
Palau	*0*
Samoa	*0*
Timor-Leste	*0*
Tokelau	*0*
Tuvalu	*0*
Wallis & Futuna	*0*

Table 3 ETM projects per country in the study region

* Projects in Tonga's jurisdiction are deep sea mining projects in the Clarion Clipperton Zone.

**Cook Islands has territorial rights over part of the Clarion Clipperton Zone (however, the S&P database only lists each project against one jurisdiction – in this case, Tonga. In future analysis we will include Cook Islands).

2.3 Data sources

In their global-level study, Lèbre et al. (2020) use 24 spatial indicators, across the seven ESG risk dimensions. For this study, minor modifications were made to Lebre et al.'s framework. We used 23 spatial indicators, and certain measures were replaced or complemented to cover gaps in data for the Pacific region (see tables in results section for details on which measures were changed). For example, Garnett et al.'s (2018) Indigenous Peoples Land map does not include data on Fiji, Solomon Islands and Papua New Guinea, and was complemented with LandMark's dataset.

In addition, we added several measures on climate change, which form part of the 'Extreme Events' risk category. These measures reflect the level of mining projects' exposure to climate change as well as national level vulnerability to climate change. Firstly, we used high-resolution spatial data from WorldClim v2.1, and calculated the absolute difference between current and future precipitations and temperature measures under a climate change scenario. Measures included in the analysis are the anticipated average changes in annual temperature and precipitation as well as changes in temperature and precipitation seasonality.

Secondly, we adopted Neumann et al.'s (2015) projection of the percentage of population exposed to sea-level rise and coastal flooding. This measure covers another dimension of climate change. It also represents a different scale as it reflects the pressures being felt by populations at a national level, rather than local conditions around the project, which are targeted by the high-resolution climate dataset.

Full list of indicators and data sources used in this analysis can be found in the dataset excel file which this note accompanies.

3. Summary of results

The analysis produced two sets of results – an aggregate ESG risk profile for Pacific ETM projects, and a comparison with datasets for global ETM projects.

3.1 Aggregate ESG risk profile for Pacific ETM projects

Our analysis allowed us to build an aggregate ESG risk profile of the Pacific ETM projects. Results are summarised in Table 4.

Field	ESG Risk Category	Results
Environment	Extreme Events	100% of Pacific ETM projects are above the medium risk threshold (0.8 m/s^2) for seismic risk.
		30% of Pacific ETM projects are exposed to tropical cyclones.
		On average, in the locations of Pacific ETM projects, annual mean temperature is expected to increase by 1.00 degree Celsius by 2040. 85% of Pacific ETM projects are expected to see an increase in precipitations as a result of climate change. On average, annual precipitations are expected to increase by 108mm, which is about 14 times the global average.
		45% of Pacific ETM projects are in countries with more than 10% of population exposed to sea-level rise and coastal flooding.
	Water	90% of Pacific ETM projects are above the medium risk threshold (score of 2) for water risks in the mining sector.
	Conservation	59% of Pacific ETM projects fall in a key conservation or biodiversity area.
Social	Land Uses	Across the set of Pacific ETM projects, the average percentage of forest land in a 10 km radius around the project is 58%.
		67% of Pacific ETM projects have croplands in a 10 km radius around the project.

	Communities	58% of Pacific ETM projects are located nearby a community.
		63% of Pacific ETM projects are in densely populated areas, i.e. with maximum population density above 10,000 people per km^2.
		94% of Pacific ETM projects fall in or near Indigenous Peoples land.
	Social Vulnerability	74% of Pacific ETM projects are in jurisdictions with low to medium human development.
		75% of Pacific ETM projects are in jurisdictions with an above median Age Dependency Ratio.
		87% of Pacific ETM projects are in jurisdictions with an above median GINI (measure of income inequalities).
Governance	Governance	0% of Pacific ETM projects are in jurisdictions with negative scores on the Voice and Accountability indicator.
		65% of Pacific ETM projects are in jurisdictions with negative scores on the Political Stability Absence of Violence indicator.
		63% of Pacific ETM projects are in jurisdictions with negative scores on the Government Effectiveness indicator.
		77% of Pacific ETM projects are in jurisdictions with negative scores on the Regulatory Quality indicator.
		73% of Pacific ETM projects are in jurisdictions with negative scores on the Rule of Law indicator.
		68% of Pacific ETM projects are in jurisdictions with negative scores on the Control of Corruption indicator.

Table 4 ESG risk profile of the Pacific ETM mining projects – summary of key findings

3.2 Global comparison

In the second stage of analysis, we were able to compare those results with ESG profiles at ETM mining projects globally. Key findings from this comparison are presented in Table 5.

<table>
<tr><th>Field</th><th>ESK Risk Category</th><th>Measure</th><th>Risk exposure for Pacific ETMs compared to global average:</th></tr>
<tr><td rowspan="10">Environment</td><td rowspan="5">Extreme events</td><td>Seismicity</td><td>Higher</td></tr>
<tr><td>Tropical cyclones</td><td>Higher</td></tr>
<tr><td>Climate change - projected changes in temperature</td><td>Lower</td></tr>
<tr><td>Climate change – projected changes in precipitations[1]</td><td>Higher</td></tr>
<tr><td>Climate change - Percentage of 2030 Population Exposed to Sea-Level Rise and Coastal Flooding[1]</td><td>Higher</td></tr>
<tr><td>Water</td><td>Mining sector overall water risk[1]</td><td>Higher</td></tr>
<tr><td rowspan="3">Conservation</td><td>Protected Areas (located within)</td><td rowspan="3">Higher</td></tr>
<tr><td>Key Biodiversity Areas (located within)</td></tr>
<tr><td>Biodiversity Hotspots (located within)</td></tr>
<tr><td rowspan="9">Social</td><td rowspan="2">Land Uses</td><td>Croplands[1]</td><td>Higher</td></tr>
<tr><td>Forest land</td><td>Higher</td></tr>
<tr><td rowspan="4">Communities</td><td>Maximum population density in a 10km radius</td><td>Lower</td></tr>
<tr><td>Maximum population density in a 100km radius</td><td>Lower</td></tr>
<tr><td>Proportion of projects on Indigenous Peoples Lands</td><td rowspan="2">Higher</td></tr>
<tr><td>Percent of Indigenous and Community Lands in Country[1]</td></tr>
<tr><td rowspan="3">Social Vulnerability</td><td>Human Development Index[1,2]</td><td>Higher</td></tr>
<tr><td>Age Dependency Ratio</td><td>Higher</td></tr>
<tr><td>Gini Index (income inequality)</td><td>Higher</td></tr>
<tr><td rowspan="6">Governance</td><td rowspan="6">Governance</td><td>Control of Corruption[2]</td><td>Higher</td></tr>
<tr><td>Political Stability and Absence of Violence/Terrorism[2]</td><td>Higher</td></tr>
<tr><td>Rule of Law[2]</td><td>Higher</td></tr>
<tr><td>Voice and Accountability[2]</td><td>Higher</td></tr>
<tr><td>Government Effectiveness[2]</td><td>Higher</td></tr>
<tr><td>Regulatory Quality[2]</td><td>Higher</td></tr>
</table>

Table 5 Comparison of ESG risk profile between Pacific ETM projects and global ETM projects

[1] Measures that were added or modified from Lebre et al. (2020)

[2] For these measures, a lower score means a higher level of risk.

3.3 Preliminary discussion of findings

Results of the analysis shows high levels of situated risk for ETM projects in the Pacific across the ESG categories considered in this study:

Extreme events – seismicity, cyclones, precipitations, and sea-level rise: Pacific ETM projects are exposed to several types of risks when it comes to extreme events – such as seismic events, tropical cyclones, and sea level rise. This cumulative exposure has wide-ranging implications in terms of planning for the long-term stability of infrastructure, mining voids (open pits and underground workings) and waste storage facilities. Failure to ensure stability of these features results in health and safety risk for both workers and local communities, as well as environmental risk. Historically, catastrophic tailings dam failures have led to multiple fatalities and contamination of waterways across several hundreds of kilometres. These risk factors also create significant challenges to site remediation and rehabilitation.

Water: 90% of Pacific ETM projects are above the medium water risk threshold, compared to 61% in the global set. This means 9 out of 10 projects face difficult freshwater conditions, and mine developers may struggle with: 1) getting fresh water supply for mining operations, 2) controlling water flows on site and keep reactive minerals away from water, 3) securing fresh water supply to nearby communities, and 4) avoiding acid and metalliferous drainage into local aquifers.

Conservation: 59% of Pacific ETM projects fall in a key conservation or biodiversity area, compared to 32% of ETM projects globally. Of the three biodiversity measures used for the analysis, Biodiversity Hotspots is the prevailing type in the Pacific region. Biodiversity Hotspots are defined as areas meeting two criteria: 1) contain at least 1,500 species of vascular plants found nowhere else on Earth; 2) have lost at least 70 percent of its primary native vegetation. This means biodiversity in the proximity of ETM projects is particularly high, and already at risk. Mining activities inevitably generate an environmental burden that negatively affects local ecosystems, as well as the people that depend on them.

Land uses: the average percentage of forest land around Pacific ETM projects is 60%, compared to a 40% global average. 67% of Pacific ETM projects intersect with croplands, compared to 58% globally. This means Pacific ETM projects experience more competition with existing land uses. As mining developers undertake land clearing at the exploration and construction stages, and then progressively acquire land when operations expand, the area of land available to the local communities decreases and local land uses – including gardening, farming and hunting grounds, are threatened.

Communities – Population Density: Two population density measures were adopted to assess the Communities risk. The first one is the presence of communities within the direct area of influence of the project, estimated to be a 10-km radius around the project. For projects that are not located nearby a community, the risk of involuntary physical or economic displacement of people living near or on top of the orebody is low. For this measure, Pacific ETM projects are on average less exposed than other ETM projects. However, the percentage of mining projects located in close proximity to communities remains high (58% of Pacific ETM projects). Here close proximity means within 10km of the project, which we consider as the direct area of influence/impact of the project. The second measure is the population density in a 100-km radius around the project. This measure provides information on the population residing within the wider area of economic influence of the project, and indirectly affected by mining operations. On average, Pacific ETM projects are in more densely populated regions than ETM projects in the rest of the world. Densely populatPed regions generally correspond to a more diversified and resilient economy that may not entirely depend on mining revenues.

Communities – Indigenous Peoples land: 94% of Pacific ETM projects are located on or near Indigenous Peoples Land, compared to 30% globally. This reflects the legal recognition of customary land tenure rights commonly found throughout the region and means that most ETM projects in the Pacific regions will need to acquire and transform land in locations where communities have strong ties to that land, and likely suffer from high levels of poverty and marginalisation (e.g. UNDP 2014). Even where population density is zero in the location of the project, Indigenous communities will have cultural and spiritual ties to the land, and may rely on the land for livelihood.

Social vulnerability: Social vulnerability measures are high for Pacific ETM projects. Three quarters of Pacific ETM projects are in jurisdictions with low levels of human development and high levels of age dependency, compared to only 18% of global ETM projects. 87% of Pacific ETM projects are in jurisdictions with high income inequalities, compared to 59% of global ETM projects. Together, these measures signal poverty, insecurity, demographic pressures, and low levels of education and health. Mining developments generate socio-economic changes at all stages of the mine life cycle that can accentuate these vulnerabilities. A frequent example is when skilled labour is brought to impoverished areas, generating further inequalities and tensions with local people. Locals may have seen their land acquired for mining purposes, while experiencing high rates of price inflation in basic markets, such as housing (Owen et al., 2021).

Governance: Our analysis shows that governance risks are higher for Pacific ETM projects than the global average across the six indicators considered in this study. High levels of corruption present in Pacific countries mean that public power is often exercised for private gain and indicates that mining revenues are likely to be captured by a small group of elite and private interests without benefiting local populations (see Burton and Haihuie 2018; Bohre Dolbear 2015). Low regulatory quality and low quality of public services generally signal that populations are unlikely to be protected from negative impacts generated by mining activities. Political instability and the absence of the rule of law indicate possible outbursts of violence and that societal rules may not be enforced. Of relevance to mining developments is the possible lack of enforcement of property rights including land rights. The only governance measure where Pacific ETM projects score positively is “Voice and Accountability”, which indicates a certain degree of democracy and freedom of expression. However, the average score for this measure is still below the global average.

Whilst we consider ESG risks across a number of distinct categories, it is important to note that situated ESG risks interact with each other, often generating complex, multi-dimensional risk that is greater than the sum of its parts (Valenta et al., 2019). For example, a remote Indigenous community with low access to drinkable water, in a jurisdiction where a corrupted government does not recognise their land rights, experiences multiple dimensions of vulnerability at a time. Multi-disciplinary expertise is needed to comprehend these risks and their interactions.

It is also important to note that when several situated ESG risks are present around the mining project, impact avoidance and mitigation strategies are paramount to prevent further harm to vulnerable people and ecosystems. The high ESG complexity surrounding Pacific ETM projects makes these strategies harder to define and implement.

4. Concluding remarks

Results from our ESG risk analysis are unequivocal:

- In the Pacific region, the conditions around ETM mining projects appear more complex and volatile than in the rest of the world.
- ETM projects in the Pacific are on average more exposed to situated ESG risks than ETM projects in the rest of the world.

In the context of the Just Transitions and the Pacific project these findings suggest that increased extraction of ETMs under conditions of climate change will amplify risks to people and the environment in the region across the risk categories discussed here.

These findings have implications for a range of actors involved in and/or affected by ETM mining activities in the Pacific. These actors include industry and regional governance bodies, local communities, and mining corporations and ETM consumers (i.e. renewable energy industries).

The latter stand to benefit from understanding the situated ESG risks around their operations and managing their ESG performance accordingly for two key reasons. First, investors increasingly require mining companies to demonstrate good performance on ESG metrics, and can divest when breaches on these metrics become obvious (e.g. Biesheuvel, 2019; The Church of England, 2020). Second, poor management of mining-induced risks and impacts can trigger conflict, which translates environmental and social risk into business costs (Franks et al., 2014; Kemp et al., 2016). Egregious misconduct (e.g. catastrophic tailings dam failure) may have far reaching implications including fatalities, damage to property, loss of license, premature mine closure, and legal action against the mining company (Kirsch 2014).

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