Just Transitions and the Pacific

Commodity Flow Analysis: Nickel from New Caledonia

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Version 3

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Work Package 2: to develop three qualitative case studies on the justice dimensions of extracting different ETMs in the Pacific under conditions of climate change: Papua New Guinea (copper), New Caledonia (nickel), and Cook Islands (cobalt)

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Country location map

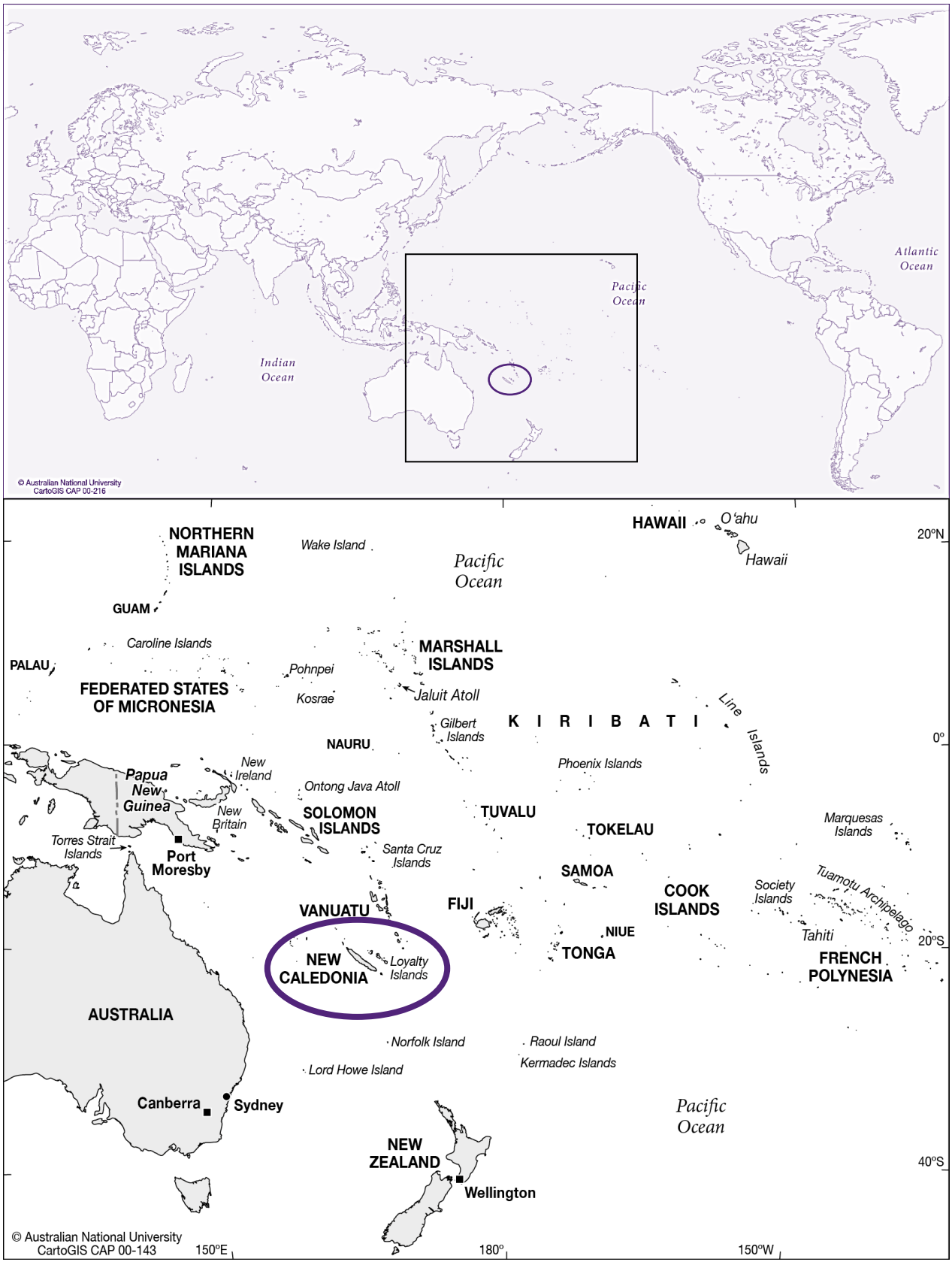

Figure 1. The Pacific region (source: ANU CartoGIS unit)

Abbreviations

Cotransmine	Compagnie de Transport Minière du Nord SAS (100% subsidiary of SMSP).
DWT	Dead weight tonnes (cargo capacity).
ETM	Energy Transition Metal.
FPIC	Free, Prior and Informed Consent.
IEA	International Energy Authority [https://www.iea.org]
KNS	Koniambo Nickel SAS.
NMC	Nickel Mining Company [subsidiary of SMSP].
OEIL	Observatoire de l'environnement ['Environment Observatory'].
PROMOSUD	Société de financement et de développement de la province Sud ['South Province Finance and Development Company'].
Schéma	Schéma de mise en valeur des richesses minières ['Framework for the Development of Mineral Resources'].
SDS	The IEA's 'Sustainable Development Scenario', an energy forecast based on compliance with the Paris targets [https://www.iea.org/reports/world-energy-model/sustainable-development-scenario-sds]
SEBA	Sécher, échantillonner, bâcher et analyser ['drying, sampling, laying out, analysing'].
SLN	Société le Nickel ['The Nickel Company'].
SMSP	Société minière du Sud Pacifique ['Mining company of the South Pacific'].
SOFINOR	Société de financement et d'investissement de la province Nord ['Finance and Investment Company of New Caledonia'].
SOMIKAT	Société Minière des Kanak de Thio ['Kanak Mining Company of Thio'].
SONAREP	Société de navigation et roulage de Poum ['Navigation and Trucking Company of Poum'].
SMT	Société des Mines de Tontouta ['Tontouta Mining Company'].
SPMSC	Société de participation minière du Sud calédonien ['South Caledonia Mining Holdings'].
SSNC	Société du Nickel de Nouvelle-Calédonie et de Corée ['Nickel Company of New Caledonia and Korea'].
STCPI	Société territoriale calédonienne de participation industrielle ['Caledonian Industry Holdings'].
STEPS	The IEA's 'Stated Policies Scenario', a conservative forecast of energy demand [https://www.iea.org/reports/world-energy-model/stated-policies-scenario-steps]
Vale NC	Vale Nouvelle-Calédonie SAS.

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1. Introduction

Case Study 2 of this project (Burton, 2022) describes the context of nickel production in New Caledonia, a French 'special collectivity' in the South Pacific, and the justice challenges expected to be faced locally if the industry is to meet an expected increase in demand for nickel stemming from the energy transition that is underway in the 2020s.

Electric vehicles and energy storage are expected to be key components of this growth. Nickel demand for those industries is forecast to increase from 81 tonnes worldwide in 2020 (3.4% of consumption across all sectors), to 987 tonnes in 2040 based on the IEA's Stated Policy Scenario (STEPS), and to 3,352 tonnes (53.5% of consumption across all sectors) based on its Sustainable Development Scenario (SDS) that pursues global climate goals (Statista, 2021a). This increase stands to shift patterns of demand for nickel from the current dominance of stainless steel production, to low-carbon power generation, electric vehicles, energy storage and hydrogen technologies. These new uses are expected to grow from the current 8.5% of renewable energy-related demand for nickel, to 31% under STEPS, and 61% under the SDS by 2040 (Statista 2021a). It is also forecast that global demand for high-grade nickel – an essential component of many low-carbon technologies – will outstrip the supply by 2024 (Rystad Energy, 2021). This is likely to put an even greater pressure on nickel producing countries and locations, exacerbating old and producing new patterns of injustice.

The patterns of nickel production and demand are illustrative of the 'planetary mine' – a complex and volatile web of supply chains spanning the globe that connects producers of extractive resources with consumers around the world (Arboleda, 2020). In 2021, New Caledonia, with 8.5% of global production, was in the top 5 nickel producing countries, behind Indonesia (36.4%) and the Philippines (14.5%), and ahead of Russia (8.3%) and Australia (7.3%)(GlobalData, 2021). In 2021 the world's leading importers of nickel and nickel products were China, Japan, United States, Norway and Germany – followed closely by the UK which ranked 6th (Statista, 2021b).

The term 'supply chain' will be frequently seen here. It is used in the general sense of the manner in which human organisations contrive to move a traded item from source to last use, or as much of the route taken as possible, not the specific sense used by a single organisation to describe its internal logistics.

If the supply chains facilitate the flow of metals between producers and consumers, they are also inherently caught up in the distribution of the costs and benefits of resource extraction and play a major role in shaping what justice issues are recognised and accounted for, and how. By testing the traceability of nickel from New Caledonia to consumer markets, we seek to explore how justice issues travel and converge along the supply chain.

This paper looks again at New Caledonia's mining industry to test whether a commodity flow analysis can be done for its principal product, nickel. To what extent is it possible to trace nickel from its source at a mine, through the various steps in its journey, first to a refinery,[1] then on to the products it is used for? If such an analysis can only be done in parts, where are the knowledge gaps and barriers?

The example of nickel will stand as a *preliminary test* of the question of whether commodity flow analyses can be done for ETMs in general. If knowledge gaps and barriers exist, what policy recommendations are needed to make the movement of ETMs around the world as transparent as possible?

1.1 Double materiality and commodity flow analysis

While the justice dimensions of each discrete step in the supply chain of nickel are not entered into in this exercise, the knowability of the environmental, social and governance (or ESG) performance at each step is a critical factor in the type of commodity flow analysis that is contemplated here.

[1] The term 'refinery' will be used here for all processing plants. More technically, 'smelter' and 'refinery' may be differentiated within the industry.

To take a contemporary example, a perfect knowledge of where each component in an iPhone has come from would be useless for what we intend here if the ESG risks, say the use of child labour or inhumane factory conditions, associated with the creation of each component remain unreported.

A relatively new concept embraced by the Global Reporting Initiative (see Section 1.3.3) is that of 'double materiality', meaning that 'Identification of matters that are financially material (or material to enterprise value) is incomplete unless the organisation has first identified its material impacts on sustainable development' (Adams et al, 2021).

Double materiality can be interpreted in the context of a commodity flow analysis in the following way: a supply chain consists of a series of steps that are typically demarcated by each being an activity with a discrete financial existence. For example, a mining company contracts a trucker to transport ore from its mine site to a loading wharf – this is at the same time a step in a supply chain and a 'job' that the mining company records as an entry low down in company's accounts. The mining company does not require more detail on how the job is carried out as long as it is done to its satisfaction.

Accordingly, we can say that commodity flow analysis is incomplete when the steps in a supply chain are identified, *unless the material impacts of each step on sustainable development and ESG performance have also been identified*.

A future, full-scale analysis will be needed to develop thinking on these concepts further.

1.2 Kinds of traceability and certification

A growth in consumer sensibility to how the things they buy are created, sometimes referred to as 'ethical consumerism' has led to the proliferation in recent decades of systems of supply chains due diligence and certification. These relate to a range of different sectors, such as agriculture, farming and resource extraction, among others.

1.2.1 Fair trade

Some of the first commodity certification organisations to be established dealt with fair trade, such as the World Fair Trade Organization (founded in 1989), the European Fair Trade Association (1990), and Fairtrade International (1997) which owns the International Fairtrade Certification Mark, introduced in 2002.

1.2.2 Animal identification and traceability

A slightly different priority has underpinned the development of rules for animal identification and traceability. In addition to providing domestic consumers with assurance that meat in the shops is correctly labelled, the spread of Bovine Spongiform Encephalopathy (BSE) in cattle across the European Union triggered a health crisis in the 1990s affecting several countries. To restore consumer confidence that animal products were safe to eat, a tracing system was introduced in 2000 (Pavón, 2018).

In Australia, the National Livestock Identification System (NLIS) was introduced in 2004 through legislation in each state and territory. This forms the basis of a nationwide system for maintaining biosecurity, food safety and providing product assurance for food exports. A Property Identification Code (PIC) uniquely identifies each farm and the NLIS database is notified whenever livestock changes hands (NSW DPI, 2017).

1.2.3 Responsibility reporting in the extractive industries

In the mining and metals sector, numerous industry associations and industry interest groups have created social performance, sustainability and financial accountability standards which have broadly similar objectives to fair trade certification, though aimed more at investors than consumers. The longer established ones include:

- The evolving sustainability reporting standards of the Global Reporting Initiative, founded in 1997 (GRI, 2022).

- The social and environmental performance reporting requirements of the International Council of Mining and Metals, founded in 2002 (ICMM, 2020).
- The financial reporting requirements of the Extractive Industries Transparency Initiative, founded in 2003 (EITI, 2019).
- The World Gold Council's requirements of its members to be compliant with its Conflict-Free Gold Standard (World Gold Council, 2012).
- The Kimberley Process Certification Scheme set up in 2003 to remove conflict diamonds from sale – diamonds mined in war zones and used to finance armed conflict (KPCS, 2003).

1.3 Criteria for a valid commodity flow analysis

The objective of all the schemes and standards is to satisfy the consumer of a product, wherever in the world it is purchased, that the steps to grow it or obtain the materials it is made from, the processes of transforming it into an end-product, and the means by which it has been brought to the point of sale have not caused harm to the environment or animals, have not occurred at the expense of the well-being and rights of people involved in the supply chain, and that the product is safe to buy.

However, whether it is a bag of coffee, a cut of beef, a diamond ring, or an electric vehicle that is being purchased, consumers can only be sure it has only been ethically produced and is safe to buy if a system of certification saying so can be relied upon.

1.3.1 Method – are forms of certification effective?

There is no shortage of criticism of the effectiveness of fair trade schemes. Field investigators have found that some offer little to coffee producers and can even be poverty traps (e.g. Valkila, 2009) while, in respect of in cocoa, the voluntary nature of initiatives aimed at reducing child labour, coupled with optimistic self-reporting, does not give confidence in their effectiveness (e.g. Ansong, 2020).

1.3.2 Longitudinal validity – is the whole supply chain covered?

The Australian system of tracing livestock illustrates a different problem. This is highly effective in providing traceability and quality assurance for commercially produced livestock. However, Australia also has a large live export trade and undercover investigations have repeatedly uncovered unacceptable animal welfare standards on transporter ships and in abattoirs in destination countries (e.g. Sinclair et al, 2018). This shows that excellent standards of responsibility in one part of a supply chain are worth little if there is a lapse in standards in another part.

1.3.3 Topic coverage – what is left out of 'responsibility reports'?

In the extractive sector, it takes little investigation to peruse the member lists of either the World Gold Council or the ICMM and see the names of multiple companies whose sites have at various times gained notoriety for conflicts, unsatisfactory resettlement programs, environmental disasters, and child labour infractions. Vale SA, a Brazilian mining company that until recently operated the Goro mine in New Caledonia through its subsidiary Vale NC is a case in point. Vale joined ICMM in 2017, after its suboptimal environmental standards were exposed when several chemical spills occurred at its Goro plant in New Caledonia. The company has drawn international attention and criticism after tailing dams at two of its mines in Brazil collapsed, in 2015 and 2019, causing major loss of life and wide-reaching environmental devastation (Owen and Kemp, 2019).

The GRI's Mining and Metals Sector Supplement (GRI, 2010), was meant to tighten sustainability reporting, but mining companies seldom, if ever, troubled to report on each of its indicators (Burton and Onguglo, 2017). It has not been updated since the G3 iteration of the standard, and is today not referenced even on the history pages of the GRI website. A new version is set to be issued in 2023.

This highlights problems to do with the 'reporting boundary'. Sustainability reporting has attained the complexity of financial reporting, without the strictness provided by accounting standards. Even the most recent iteration of ICMM reporting requirements still only require the 'minimum Core Option' of the GRI standard to be applied and companies may choose which sites to report on, notably allowing the exclusion of non-managed joint ventures (ICMM, 2021). At each reported site, a 'materiality analysis' (if in fact used) may determine what it is relevant to report on. This can well exclude civil conflicts, the living condition of poor migrants attracted by a mine, or the dangerous working conditions of artisanal miners working in mine tailing areas. It is a recurrent problem (e.g. War on Want, 2007; Human Rights Watch, 2010; Lohdia and Hess 2014; Oxfam 2019; Talbot and Barbat 2020) that 'responsibility reports' can fail to mention critical justice issues in which extractive industry operations are implicated.

1.3.4 Some questions that valid commodity flow analysis must address

When considering whether energy transition metals (ETMs) can be followed from source to end use in a way that will satisfy standards of ethical production / consumer sensibility, we need to ask a series of questions:

1. Is it technically possible, using available or foreseeably collectable data, to follow commodities from the mine in one part of the world to the point of consumption in another?

2. If it is technically possible, can it be done reliably, and can this be repeated?

3. What topics should be covered to illuminate justice issues along the full length of a supply chain?

4. If a supply chain is highly branched, ETMs will flow from few points of origin to many refiners, after that to many manufacturers, and after that be made into many products. The major 'arteries' of a branched supply chain may be obvious, but the 'peripheral arteries' and 'capillaries' may not be. What criteria should be used to determine what to cover and what to omit?

2. Commodity flows in the New Caledonian nickel industry

Information about commodity flows in the New Caledonian nickel industry is not readily available. As part of the Just Transitions and the Pacific project, we tested how far we are able to trace nickel ores produced in New Caledonia from their points of extraction, using publicly available information, in two cases: the supply chain from NMC sites to Asian refineries, and the shortened mine-to-supply chain from SLN mines to its refinery at Doniambo – and beyond. We present our results here.

2.1 Brief overview of the New Caledonian nickel industry

Nickel is the most important commodity mined in New Caledonia, the world's third-largest nickel producer in 2021, with exports totalling 206,000 tonnes of contained nickel or about 8.5% of world production (GlobalData, 2021).

At the present day, three vertically integrated companies are able to mine, process, and export nickel: Société Le Nickel (SLN), founded in 1880 and headquartered in Nouméa; SMSP, owned by the North Province, with a refinery at Vavouto in joint venture with Glencore (Horowitz, 2008; Kowasch, 2017); and Prony Resources New Caledonia, a consortium formed in 2021 to take over operation of a mine and refinery at Goro in the South Province (Horowitz, 2014; Levacher, 2017).

Twenty or more second-line companies that are only engaged in parts of the process of mining, and do not do their own refining, operate across the territory and are loosely known as *petits mineurs* ('small miners'). Some are well capitalised and export unprocessed nickel ore, like SMSP's subsidiary, NMC ('Nickel Mining Company'), while others are restricted to subcontracting to the bigger companies, or do mining and use small coastal bulk carriers to ship ore from coastal wharves to one or other of the refineries (Bouard et al, 2019).

2.2 Case 1 – The supply chain from NMC sites to Asian refineries

Nickel Mining Company (NMC) is a joint venture of SMSP and the Korean steelmaker POSCO, in which SMSP is the 51% shareholder. NMC holds titles at four mining centres: Ouaco, Kouaoua and Nakéty in the North Province, and Poya, which straddles the North and South Province border. Its purpose is to supply garnierite, containing 1.9-3.0% nickel, to the SMSP-POSCO refinery at Gwangyang, South Korea, and lower-grade laterite, containing <1.8% nickel, to the refinery at Yangzhou, China. It would not be economic to refine either of these products in New Caledonia. NMC exported 2.9 million tonnes of garnierite to Gwangyang and 390,000 tonnes of laterite to Yangzhou in 2020.[2] NMC hold the mining titles at the four sites, but other actors are involved in mining, the movement of ore from the working face at a mine to the coast, loading, and ocean transport to the sites to Korea and China. Figure 2 shows the layout of the area worked by NMC at Kouaoua of the east coast of New Caledonia.

2.2.1 Quality control

A key to modernised mining in New Caledonia is repeated assays at a mine site to guide the separation of grades of material being excavated. At a minimum, a first assay point is at the mine in front of the shovel, a second is where loads are made up for trucking to the wharf, and a third is in the lay down area at the wharf where ore is prepared for shipment. NMC has an internal methodology known as SEBA, which refers to the steps that are taken to ensure a consistency of nickel content, granularity and water content.[3] This step uses an organisational unit of laboratory technicians and mineral chemists split between NMC and its partner POSCO.

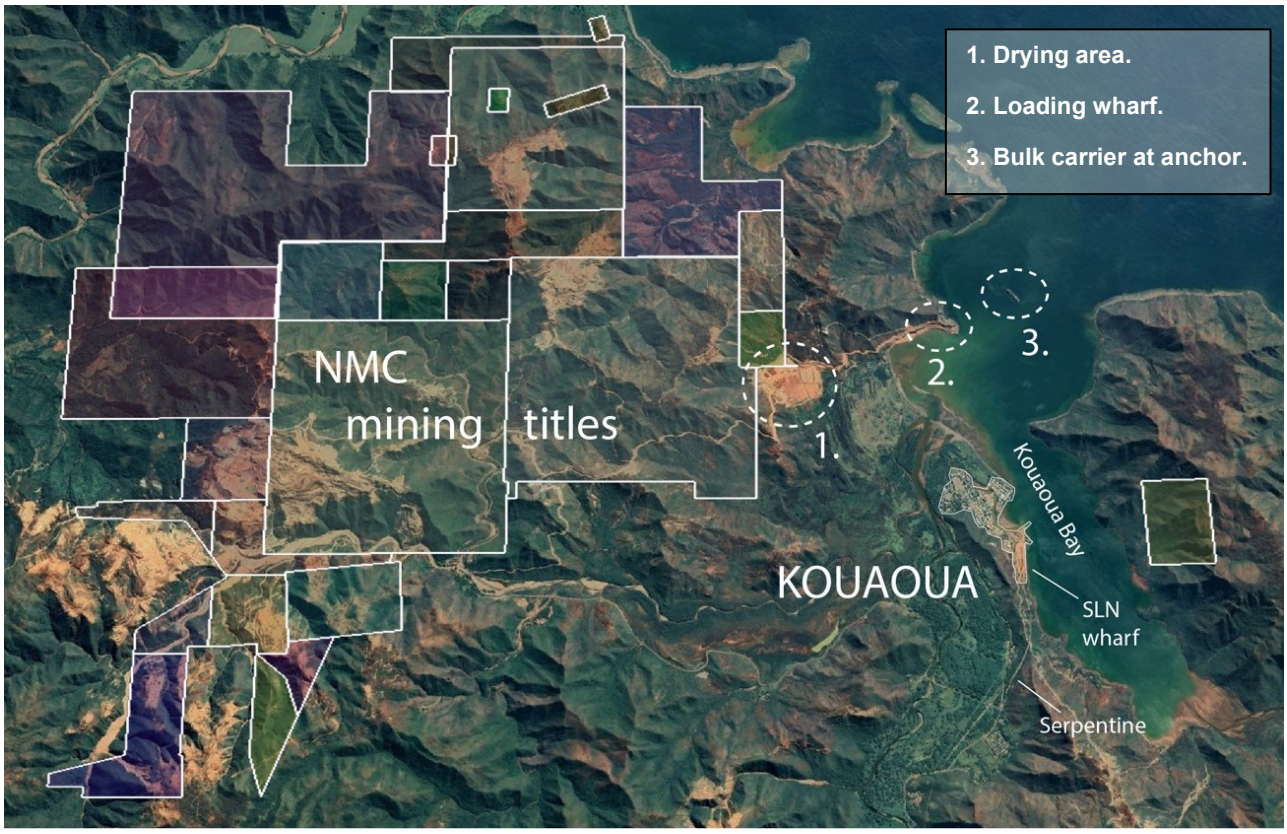

Figure 2. NMC mining titles at Kouaoua, New Caledonia.
Map base: Google Earth. Data: DIMENC. Annotation: John Burton.

[2] Information for this and the following sections are informed by the author's research visits to NMC sites in 2016-17 and information available on the NMC's website. See: https://nmc.nc/.

[3] International standards for the transport of loose materials apply in respect of the safety of ships at sea.

2.2.2 Tâcherons – contract miners

The French word *tâcheron* normally translates into English as 'day labourer', a worker who has no more than basic skills and is paid by the task completed. In New Caledonian mining, however, *tâcherons* are specialised contract miners with sought-after skills in the precise excavation of nickel-bearing layers. NMC typically delegates the mining of its sites to *tâcherons*. Their job is to discriminate between the sterile and various kinds of nickel-bearing layers at the working area of a mine, excavating the latter and moving it to a nearby storage area. When firms involved in *tâcheronage* use exceptionally skilled operators, it makes a substantial difference to the profitability of the operation (Bouard et al, 2019).

As noted below, involvement in mining, including *tâcheronage*, has been a key demand of *coutumiers* ('customary representatives') at sites all over New Caledonia since the 1990s and has been realised through the establishment of Kanak-owned companies.[4]

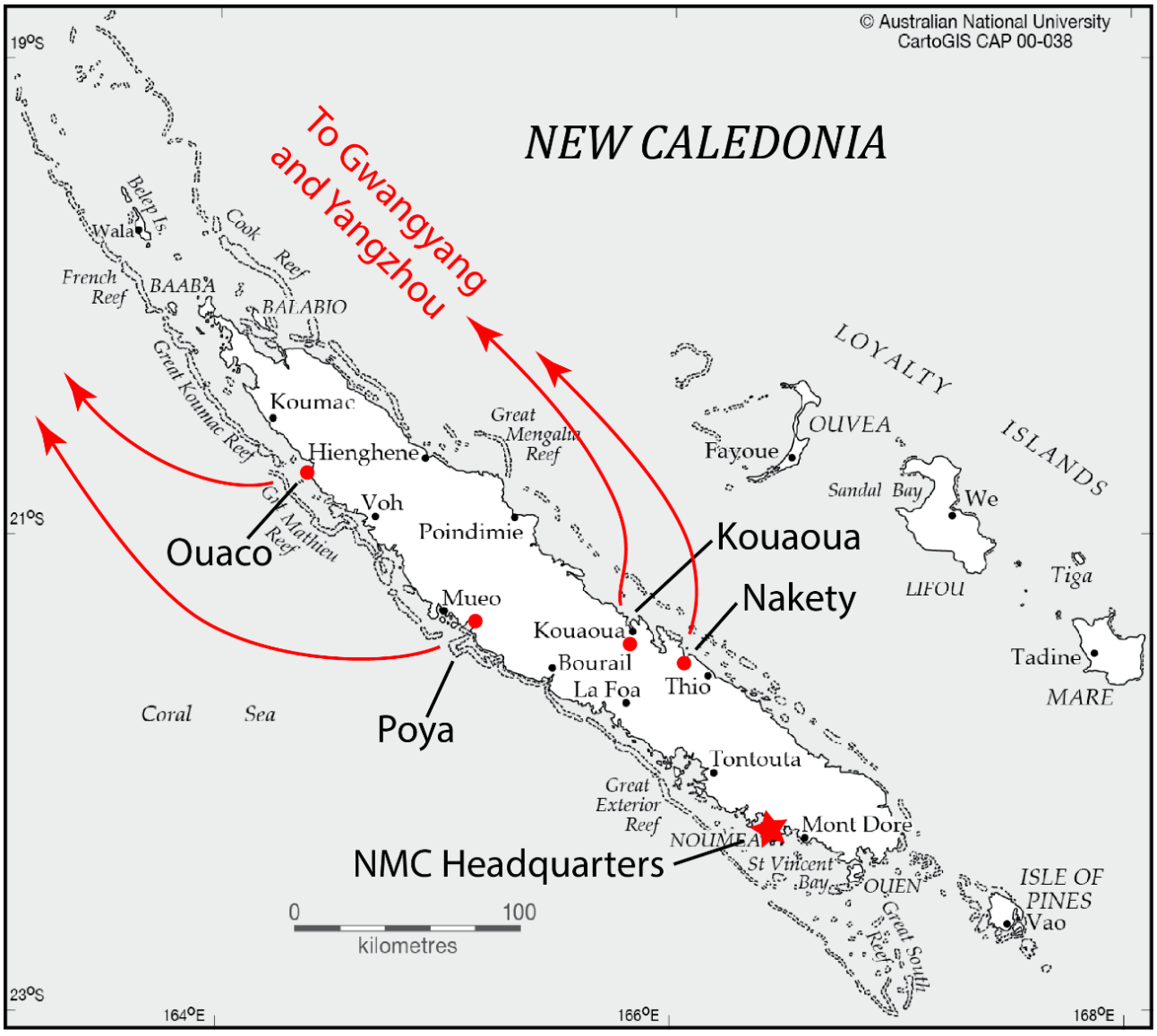

Figure 3. NMC's exports of garnierite and low-grade ore to Gwangyang and Yangzhou.
Map base: ANU CartoGIS. Annotation: John Burton.

[4] *Les Kanaks*: Indigenous Melanesian inhabitants of New Caledonia (also known as *Kanaky*).

2.2.3 Rouleurs – trucking contractors

Contract truckers, known as *rouleurs* (New Caledonian French, lit: 'rollers'), transport the ore from the area at a mine site where excavated material is crushed and screened to a lay-down area at a coastal wharf, which can be up to 20km away depending on the directness of the mine access roads. *Rouleurs* do not have the skills that *tâcherons* have and their only job is moving ore from the site to the coast. They may form into associations but are typically small independent firms. Drivers can be of any ethnicity but, again, *coutumiers* have pushed to gain more employment in this sector.

Figure 4. SMSP exports of low grade ore to Yangzhou and Gwangyang.
Source: ANU CartoGIS. Annotation: John Burton.

2.2.4 Chalandage – barging of ore out to bulk carriers

The term *chalandage* (New Caledonian French, from *chaland*, a barge) refers to the task of barging ore from the wharf to a bulk carrier anchored offshore in deeper water. An SMSP subsidiary, Cotransmine, carries out this work at the four NMC sites (Figure 2, Figure 3) using a fleet of flat barges towed by tugboats. The bulk

carriers have their own cranes to load ore from the barges drawn up alongside them. On the west coast, bulk carriers stand off some 5-6km from the coast while on the east coast the distance from shore to ships is around 1km. Cotransmine had around 100 staff in 2020 and notably engaged employees from the communities near the loading wharves.

2.2.5 Ocean transport to the Asian refineries

Bulk carriers move ore from New Caledonia to the metallurgical refineries in Asia. On 18 February 2022, 12 vessels were at anchor in bays around New Caledonia, one was at the wharf at Doniambo, Nouméa, one was on its way to New Caledonia and one was on its way to Asia, according to the 'Marine Traffic' website.[5]

It is not possible to tell with certainty which ships were loading from the sites belonging to which mining company, or where the crews come from, but details of the vessels give some indication of who is involved. The vessels vary in cargo capacity in two ranges: from 24,000 to 30,000 DWT (dead weight tonnes) and from 40,000 to 60,000 tonnes. The smaller ships are typically engaged in domestic ore carrying while the larger ones are usually destined for Asian ports. Given that NMC exported a total of 3,290,000 tonnes of nickel ore in 2020, this indicates that between 55 and 60 shipments were sent to Asia in the year in vessels the size of the *Fortune Tiger* (Figure 5), 58,000 DWT, which was anchored off Kouaoua on 1 March 2022. This a rate of just over one per week.

Figure 5. The *Fortune Tiger* at berth in Casablanca.
Source: Wikimedia Commons. Photographer: Farid Mernissi.

[5] See: https://www.marinetraffic.com/.

A photograph on Wikimedia Commons shows this vessel at berth in Casablanca at an unknown date. Its dead weight tonnage makes it among the largest of the vessels serving New Caledonia. When in use as bulk carriers, vessels like this are fitted with specialised loading cranes.

Photographs online at marinetraffic.com also show the *Fortune Tiger* at Gibraltar, Philadelphia, River Plate, Taiwan, and Vladivostok at various dates, illustrating that vessels of this nature serve many routes over time, carrying many different types of bulk cargo.

Nine of the vessels in New Caledonian waters in February 2022 were Panama flagged, three were registered in Malta, and the others in Hong Kong and Marshall Islands. The ownership of the vessels is obscured by the use of shell companies. For example, the PM Hayabusa, a 58,000 DWT bulk carrier standing off Tontouta on the west coast on 12 February 2022, was registered in Panama and listed as owned by Sun Panama Shipping SA. This in turn appears to be owned by Hayama Shipping Ltd of Tokyo. A more specialised forensic investigation would be needed to trace all the vessels employed in the ore carrying trade to and from New Caledonia. The vessels were, on average, nine years old, which is relatively new by world shipping standards.

It is not possible, on the basis of publicly available data, to trace nickel ore from New Caledonia beyond the general destination of the steel makers in Yangzhou (China) and Gwangyang (South Korea). Considering the current dominance of stainless steel production in nickel markets (70% share of demand) it is most likely that New Caledonia's nickel ore was predominantly raw material feed to produce stainless steel. But with low-carbon generation, electric vehicles, energy storage and hydrogen technologies expected to become the dominant consumer of the world's nickel production by 2040, these findings retain relevance for our consideration of justice dimensions of ETM supply for the global energy transition.

2.2.6 NMC's supply chain – many actors, many specialisations

To summarise the above, the catch-all term 'the mining company' actually conceals a wide range of actors some of whom are under the control of the holder of a mining title, and others of whom are not. These range from small- and mid-sized employers at community level, through to skilled excavators, scientific technicians who include team members trained by POSCO, and intersect with another, globally organised supply chain, namely shipping. In all likelihood, the shipping companies subcontract to crew management companies which supply crewmen from all over South East Asia, with a favoured source being the Philippines. Crew conditions must meet the 2006 ILO Maritime Labour Convention; a guide to correct practice was recently published by the International Chamber of Shipping (ICS, 2021).

An example of a Kanak-run company that does *tâcheronage* is SOMIKAT. Le Meur (2017) describes how this arose out of a conflict in 1996 in which Plateau and Camps des Sapins, the two main mines at Thio on the east coast of New Caledonia, were blockaded by *coutumiers* over a log of claims demanding more local involvement in mining. In took ten years for the company to be granted a mining licence, but it has been in full operation since 2010. A SOMIKAT LinkedIn page carries the following vision statement:

> *'SOMIKAT … is a symbol of economic rebalancing (rééquilibrage) and the sharing of wealth in an enduring and sustainable manner'.*[6]

An example of a Kanak-run company that entered the mining industry through *chalandage* is SONAREP,[7] founded in 1996. Its shareholders and directors are drawn from the Boaouva clan (majority owner) and four tribal areas in the extreme north of New Caledonia. It recently had barging operations at site locations around New Caledonia, including Kouaoua. In recent years, SONAREP has branched out into mining, trucking and small enterprises around the commune of Poum, and now has between 150 and 200 employees.

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[6] See: https://nc.linkedin.com/in/somikat-thio-sarl-783b2b232.

[7] See: https://sonarep.com/.

2.3 Case 2 – SLN's 'old economy' supply chain

New Caledonia's oldest mining company, Société le Nickel (SLN) illustrates a shortened mine-to-refinery processing chain. In 1910, the *Société des Hauts-Fourneaux de Nouméa*, a company that SLN later acquired, opened a smelter at Doniambo on the outskirts of Nouméa. Ownership is today split between the French minerals group Eramet (56%), the holding company STCPI jointly owned by New Caledonia's three provinces (34%), and Nisshin Steel (10%) (see Newbury 1955; Bencivengo 2014; Black 2014).

The Doniambo plant is still in operation and is fed by SLN's mining centres at Thio and Kouaoua on the east coast; and Népoui-Kopéto, Tiébaghi and Poum on the west coast. Ore is transported to the refinery in smaller-sized bulk carriers from coastal wharves near the mines to Doniambo (Figure 6).

Figure 6. Domestic shipment of nickel ore to SLN's Doniambo refinery.
Source: ANU CartoGIS. Annotation: John Burton.

2.3.1 Method of mining

The operations at SLN's sites at Thio, Kouaoua, Népoui-Kopéto, Tiébaghi and Poum follow much the same model of *tâcheronage*, *roulage* and *chalandage* as seen for NMC. One difference is that the large Méa mine, to the south of Kouaoua is joined directly to SLN's loading wharf by a 11km conveyor system built in the 1970s known as Serpentine (Figure 2).

SLN has its own laboratories and technical staff for onsite sampling and assaying. SLN's operations depend, like everyone else's, on good local relationships with *coutumiers*. The blockades at Thio in 1996 have already been mentioned (Le Meur, 2017). At Kouaoua, a local group known as Chêne Gomme led protests between 2017 and 2020 over a mix of environmental impacts of expanded SLN operations at Kouaoua and youth unemployment issues. A peace agreement was signed at Kouaoua in mid-2020 in which it was agreed that SLN's expansion plans would be reduced by 40%, that a monitoring committee would be established, and that the parties would endeavour to better articulate relationships between customary authorities, mining companies and contractors in the area (LNC 2020, July 6).

2.3.2 SLN's supply chain between wharf and refinery

Rather than using large bulk carriers to move ore from New Caledonia to metallurgical refineries in Asia, SLN uses smaller ones to move ore from its mining centres to Doniambo. On 26 February 2022, the 27,000 DWT vessel *Araucaria* was moored at Doniambo, having come from its last port of Nepoui. The 27,000 DWT *Jules Garnier II* was moored alongside, having come from Tiébaghi.[8]

Both vessels are registered in Panama. The registered owner of *Araucaria* is Nissho Shipping Panama Inc and of *Jules Garnier II* is Sunny Durban Maritime SA. Both ships are managed by ENEOS Ocean Shipmanagement Pte Ltd of Singapore.[9] Little is known about the conditions on board, the contract terms of the crews, or whether management of the vessels is compliant with the ILO Maritime Labour Convention.

2.3.3 The nickel supply chain after it leaves SLN

SLN exports a single product in 2022 known as 'SLN25', comprising ferronickel pellets (Figure 7), a second-grade product destined to be primarily used in the making of stainless steel. SLN is the world's largest producer of this form of nickel, and the pellets have a typical composition of 20-28% nickel, 0.65% chromium and 0.6-0.8% cobalt (Eramet, 2016, 2018).

Figure 7. SLN25 ferronickel pellets.
Source: FranceTVInfo (2016).

[8] See: https://www.marinetraffic.com/.

[9] Details from various vessel finder websites.

Customers who place orders for SLN25 could be located anywhere in the world. Five years ago, SLN's 'principal clients' were (FranceTVInfo, 2016):

- Aperam. Headquarters in Luxembourg, with production facilities in Brazil, Belgium and France. It is a manufacturer of stainless steel and various metal alloys. Aperam has issued annual sustainability reports since 2011 and claims to be 'Best in class in ESG' (Aperam, 2021).[10]
- Outokumpu. Headquarters in Helsinki, with production facilities in 30 countries. Shares held by the government of Finland several Finnish pension funds make up 26% of the equity. Outokumpu claims to be 'the global leader in sustainable stainless steel'. 'Sustainability reviews' have been produced since 2016.[11]
- ThyssenKrupp. Headquarters in Germany, with production facilities in 56 countries and employing 100,000 people. It produces a wide range of construction materials, special steels and alloys. It produces summary ESG information only.[12]
- Acerinox. Headquarters in Madrid, the company is a manufacturer of rolled steel, stainless steel and special alloys. It has issued annual sustainability reports since 2016.[13]

This is likely only to be accurate for the year it was written, 2016. Steelmakers, such as these respond to price and it is not clear that ferronickel produced by SLN has a quality markedly different from that made by other producers. This said, Krupp is a long-standing client of SLN, having been a member of the Steel Manufacturer's Nickel Syndicate, formed by European armaments firms led by Vickers Sons & Maxim to establish a preferential supply agreement with SLN, from 1908 to 1914. At the time, nickel steel was also as 'Krupp' steel.

2.3.4 A 'new economy' initiative

In 2020, BASF and Eramet signed an agreement to assess the development of a High-Pressure Acid Leaching (HPAL) plant, similar to the Goro refinery, and a base metal refinery to supply BASF with 40,000 tonnes of nickel and 5000 tonnes of cobalt annually. BASF is in the battery materials business and it is known that it has signed an exclusive agreement to supply the carmaker Porsche with battery components (Porsche, 2021).

If the initial assessment is favourable, a feasibility study will follow. The start of construction of any plant – it is not indicated where the plant would be located – would take place in the mid-2020s at the earliest.

2.3.5 Many uses of nickel alloys – impractical to trace further

The number of different nickel alloys in use has multiplied enormously in the last half century. For example, Fushun Special Steel Co Ltd says it manufactures 5400 kinds of steel, many containing nickel, each with different properties – high tensile, low expansion, resistance to oxidisation and seawater, high-temperature applications in aerospace, and so on.[14]

If these are 'old economy uses', the enormous proliferation of nickel alloys in modern manufacturing means it is likely, *even without the energy transition*, that the demand for nickel will remain high into the future. It also means that it is impractical to trace New Caledonian nickel further into the multitude of products that it can be found in.

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[10] See: https://www.aperam.com/

[11] See: https://www.outokumpu.com/

[12] See: https://www.thyssenkrupp.com/en/investors/esg-information-for-capital-markets

[13] See: https://www.acerinox.com/en/grupo-acerinox/sostenibilidad/

[14] https://www.fushunspecialsteel.com/.

2.4 Case 3 – Prony Resource's 'new economy' supply chain

2.4.1 New Caledonia's newest mining company

New Caledonia's newest mining company, Prony Resources New Caledonia, is a consortium formed in 2021 to take over the operation of the mine and refinery at Goro in the South Province that was previously developed by Vale NC.

For the purposes of this discussion, the details of how Prony extracts nickel ore from its mining area will be passed over. Suffice it to say that there is a structurally similar situation of subcontracting at Goro to what is seen at NMC or SLN sites. In this case, the company whose shareholders are drawn from among local *coutumiers* is SAS Goro Mines. It is instrumental in coordinating participation by local communities in contracting at Goro (Levacher, 2017).

Depressed nickel prices and difficulties in getting Goro's High Pressure Acid Leaching (HPAL) processing plant to work saw an overall investment by the previous owner, Vale, of as much as USD 9 billion over a decade for little return (RNZ, 2020, June 5).

To simplify the refining process, Vale NC decided to bring an intermediate product to market, Nickel Hydroxide Cake (NHC), abandoning the original idea of creating a purer metal product (Vale 2010). NHC has a composition of 37% nickel and 2-3% cobalt. The high concentration of the latter means that it is economically viable to extract cobalt – also an ETM – with a further process. When the economics of doing this still looked unfavourable, Vale announced it would sell Goro.

2.4.2 Prony Resources and the Tesla ETM deal

In 2021, ownership of the Goro mine and refinery passed to a new 51% locally-owned consortium, Prony Resources (LNC, 2021, April 1).

What makes the case noteworthy is that six months after the deal, Tesla Inc signed a contract for Prony to supply its electric vehicle factories in Asia with 42,000 tonnes of nickel annually for at least five years (LNC, 2021, October 14).[15]

The Prony-Tesla deal signalled the first major order (the BASF-Eramet-Porsche agreements are non-committal at this stage) to be signed up directly between a New Caledonian exporter and a manufacturer at the forefront of the energy transition. It set up New Caledonia's first 'new economy' supply chain, and this differs in important respects from the situations seen in the first two cases.

In the NMC case, the bulk export of low-grade nickel ore pushed key parts of the total supply chain onto ocean shipping and to refiners / steelmakers in another market. In the first instance, some 65 round trips to Asia by ship are needed annually to export nickel ore from NMC sites.

In the SLN case, onshore refining has resulted in a compact product and only one large ship – in theory – would be needed to export a whole year's production.

However, in both cases the manufacturers that either NMC or SLN nickel is eventually supplied to make thousands of different products, which it is impractical to trace further.

Prony Resources, however, is contracted to supply a manufacturer making essentially a single product, creating a supply chain that is highly traceable. Again, only one large ship – in theory – would be needed to export a whole year's production.

[15] As far as is known Prony is not restricted to only selling NHC to Tesla if its output is more than this.

3. Discussion

Three key questions emerge from the three cases considered above.

3.1 Would a fairness or assurance initiative into tracing nickel be effective?

This means, in the first place, answering whether it is technically possible, using available or foreseeably collectable data, to follow nickel from a mine in New Caledonia to the point of consumption in another part of the world?

The answer is that good data is available from public institutions on where mining operations take place, who is involved, and the demographic profiles of the communities involved. Among the key institutions are:

- DIMENC, the government of New Caledonia's mining regulator.
- Géorep, the government of New Caledonia's spatial data agency.
- ISEE, the government of New Caledonia's agency for statistics and economic studies.

Between them, DIMENC and Géorep maintain a mining cadastre that can be displayed using an online mapping tool. This makes tracing nickel mining operations (cf. Figure 2) technically feasible, and data are reliable and replicable over a period of years.

Against this, the industry is made up of six or seven quite large companies, a few medium-sized companies, and several hundred small ones. Some of the bigger companies have websites (SMSP, Prony Resources, Société des Mines de Tontouta) but others do not (notably SLN). None does any sustainability reporting in New Caledonia.

It is notable that SLN's parent company, Eramet, became a member of the UN Global Compact in 2019. Its latest Communication of Progress took the form of its 2021 Universal Registration Document (Eramet, 2022), which is simply a generic form of a company's annual report and financial statements. The Global Compact rated its compliance with its ten principles as 'Meets all criteria for the GC Advanced level'.[16] However, the Global Compact expects members to make use of companion sustainability frameworks such as the Global Reporting Initiative (UN Global Compact, 2015). Eramet's reporting ignores this. How can we be sure its reporting really reflects the situation of the ground?

The lack of industry reporting makes it impossible, with existing data, to determine with consistency how many employees each company has and the breakdown of where workforces are recruited from. Individual researchers have approximated this information through social surveys for particular operations (e.g. Kowasch, 2017, around the Koniambo refinery), but the findings only apply to the years in which the research was done.

Similarly, production data is reported by some companies, but this is usually in the form of gross output by tonnage. Drilling down to obtain the flows of nickel ore by mine site to refineries is not currently possible. What happens to the contained nickel when shipments of low-grade ore are sent to Asian refineries is not currently (or will perhaps ever be) knowable.

3.2 Longitudinal validity – is the whole of the supply chain visible?

We have demonstrated that the potential for traceability is present in New Caledonia, even if availability of data is in parts patchy. However, the high significance, but low transparency, of the international shipping business means that a major link in the nickel supply chain can barely be monitored.

[16] https://www.unglobalcompact.org/participation/report/cop/create-and-submit/advanced/451802.

This is a situation where vessel arrival and departure times are knowable in real time, via the many 'vessel finder' websites, and the nature of the cargoes (type and origin of nickel ore), they are carrying is potentially knowable. But the ESG issues of the organisations that operate the vessels, and the workplace conditions of the crews, are not readily visible to the outside observer. This lack of transparency affects the NMC-to-Gwangyang and NMC-to-Yangzhou supply chains, simply because of the greater number of shipping movements that are involved compared with the supply chains that involve New Caledonia's onshore refineries.

Similarly, once refined nickel leaves a steelworks or metallurgical factory, further manufacturing steps and end uses are not readily knowable. For example, part of the same batch of New Caledonian nickel might be made into a set of dinner cutlery or high-performance fan blades for the engine of a combat aircraft. It is infeasible to trace whose nickel went in which direction.

3.3 Topic coverage – what to leave out of a commodity flow analysis?

What topics should be covered to illuminate justice issues along the full length of a supply chain?

As noted in the introduction, the kind of full commodity flow analysis contemplated here – for which the current document is conceived of as a *preliminary test* – must incorporate the dual knowledge of the *steps* in a supply chain and the *ESG performance* observed at each step. It was noted that this is a form of *double materiality*.

This raises the question of what ESG topics to cover when going through such an exercise. The Global Reporting Initiative requires reporters to examine 'materiality and topic boundary', and detailed guidance is provided for doing so.[17]

However, if a supply chain is highly branched, ETMs will flow from few points of origin to many refiners, after that to many manufacturers, and after that be made into many products. The major 'arteries' of a branched supply chain may be obvious, but the 'peripheral arteries' and 'capillaries' may not be. This complicates the criteria that should be used to determine what to cover and what to omit.

4. Conclusion

As a *preliminary test* of the question of whether a commodity flow analysis can be done for a selected ETM, we have shown that such an exercise is possible, within limits. We have also argued that the concept of *double materiality* is critical, such that a commodity flow analysis must be considered incomplete when the steps in a supply chain are identified, unless material impacts of each step on justice issues and ESG performance are also identified

Three supply chain cases were looked at here:

1. A case where the bulk shipping of ore was positioned in the middle of the supply chain, between steps in New Caledonia and further steps in Asia controlled by majority-owned New Caledonian refineries.
2. A case where most of the supply chain is located within New Caledonia, where one standard product is exported to a few large customers who then create thousands of different end-products.
3. A case where most of the supply chain is located within New Caledonia, but where one standard product is exported to a single large customer who uses it to create a single end-product.

[17] https://globalreporting.org/how-to-use-the-gri-standards/questions-and-answers/pre-2021-gri-standards-system-faq/materiality-and-topic-boundary/.

Each of these cases illustrates a different degree of knowability of the total commodity flow. Following the concept of double materiality, each also illustrates the different degree to which ESG performance is practically knowable along the supply chain.

Many knowledge gaps exist, some of which may be considered shortcomings in sustainability / responsibility / ESG reporting, while some of which may be considered to be caused by less resolvable barriers to knowledge.

An example of the former is the small effort put into formal sustainability / responsibility reporting by companies operating in New Caledonia. This could easily be made good if the advice of any of the readily available guidance documents was followed (e.g. UN Global Compact, 2015; EITI, 2019; ICMM, 2020; GRI, 2022).

An example of a more serious barrier to knowledge is the transparency-poor nature of the shipping industry. This would be very difficult for the nickel industry of New Caledonia to influence, let alone make good.

An example of an unresolvable barrier to knowledge is what happens to nickel from a source in New Caledonia when it is alloyed with other metals in a furnace in a distant country. It is physically impossible to trace New Caledonian nickel any further among the thousands of products manufactured by specialist metallurgical companies.

The question of what topics should be covered to illuminate justice issues along a supply chain remains open. Just as a range of justice issues can occur at the point of extraction, we may also expect to find procedural, distributive, and restorative justice issues occurring along the supply chain. These may be expected to include labour conditions and the terms of participation of Indigenous and land-connected people, the environmental impacts of refining, and such matters as physical and economic displacement associated with the construction of refineries, ports, rail lines and other industrial infrastructure. It is suggested that rather than trying to settle on a list of topics, that the different justice dimensions (procedural, distributive, restorative, and two universal dimensions) are used to help identify issues and topics relevant to specific supply chains. But we must also attend to the relationship and convergences between these justice dimensions along the supply chain.

The variability of supply chains, between major arteries and smaller capillaries, presents obvious challenges. But this cannot be an excuse for prioritising some supply chains over others. If a just transition is to be achieved, development of ‘clean’ and ‘green’ technologies in some parts of the world should not come at the cost of harmful environmental and social impacts in other countries and regions. The focus on the full length of supply chains, from the extraction of raw materials, through their transformation and transportation, to the manufacturing of end products, is not yet a consistent feature of just transition discourses. As the cases from New Caledonia demonstrate, the effort to achieve a genuine just transition means paying attention to justice convergences within and along the whole length of the supply chain.

5. References

ADAMS, C.A., ALHAMOOD, A., HE, X., TIAN, J., WANG, L. AND WANG, Y., 2021. *The double-materiality concept: application and issues*. Amsterdam: Global Reporting Initiative

ANSONG, A., 2020. SDG 8 and elimination of child labour in the cocoa industry in Ghana: Can WTO law and private sector responsible business initiatives help? *Forum for Development Studies, 47*(2), 261–281. https://doi.org/10.1080/08039410.2020.1786453.

APERAM, 2021. *Aperam ESG presentation 2021*. Luxembourg: Aperam.

ARBOLEDA, M., 2020. *Planetary mine: territories of extraction under late capitalism*. London: Verso.

BOUARD, S., LEVACHER, C., BENCIVENGO, Y., DECOTTIGNY, L., DEMMER, C., LE MEUR, P-Y., BLAISE, S. BURTON, J., ENJUANES, F. GROCHAIN, S., 2019. *Petites et moyennes entreprises minières en Nouvelle-Calédonie. Rapport Scientifique Final*. Pouembout, New Caledonia: Consortium IAC, IRD, CNRS, UNC, DWU. Retrieved from https://cnrt.nc/uncategorized/2-rapports-scientifiques-lies-au-projet-pme-minieres-en-nouvelle-caledonie/.

BURTON, J. 2022. The Justice Dimensions of Extracting Energy Transition Metals in the Pacific. Case Study 2: Nickel in New Caledonia. Just Transitions and the Pacific Project: University of St Andrews and University of Queensland. Accessible from: https://jtpac.wp.st-andrews.ac.uk/outputs/

BURTON, J., & ONGUGLO, J., 2017. Disconnected development worlds: Responsibility towards local communities in papua new guinea. In C. Filer & P.-Y. Le Meur (Eds.), *Large-scale Mines and Local-level Politics: Between New Caledonia and Papua New Guinea* (pp. 261–289). Canberra: ANU Press. https://doi.org/10.22459/LMLP.10.2017.09.

EITI, 2019. *The EITI Standard*. Oslo: Extractive Industries Transparency Initiative. Retrieved from https://eiti.org/.

ERAMET, 2016, August 16. *SLN focuses on SLN25 ferronickel production*. Media release. Retrieved from https://www.eramet.com/en/sln-focuses-slnr-25-ferronickel-production.

ERAMET, 2018. *SLN25. Bringing value to stainless steel makers*. Retrieved from https://www.eramet.com/sites/default/files/inline-files/eramet_sln25_2018.pdf.

ERAMET, 2022. *2021 Document d'enregistrement universel*. Paris: Eramet.

FRANCETVINFO, 2016. Eramet a triste mine, mais le nickel SLN25 calédonien se vend bien. *FranceTVInfo Outre Mer.* Retrieved from https://la1ere.francetvinfo.fr/2016/02/11/eramet-triste-mine-mais-le-nickel-sln25-caledonien-se-vend-bien-330551.html.

GLOBAL DATA, 2021. The top five Nickel producing countries (Thousand Tonnes, 2021). Retrieved from https://www.globaldata.com/data-insights/mining/the-top-five-nickel-producing-countries-thousand-tonnes-2021/

GRI, 2010. *Mining and Metals Sector Supplement*. Amsterdam: Global Reporting Initiative.

GRI, 2022. *GRI 1: Foundation 2021. Universal Standard*. Amsterdam: Global Reporting Initiative. Retrieved from https://www.globalreporting.org/.

HUMAN RIGHTS WATCH, 2010. *Gold's costly dividend. Human rights impacts of Papua New Guinea's Porgera gold mine*. New York: Human Rights Watch.

ICMM, 2020. Mining Principles. Performances expectations. London: International Council of Mining and Metals. Retrieved from https://www.icmm.com/website/publications/pdfs/mining-principles/mining-principles.pdf.

ICMM, 2021. *Assurance and validation procedure*. London: International Council of Mining and Metals. Retrieved from http://www.icmm.com/website/publications/pdfs/mining-principles/assurance-and-validation.pdf.

ICS, 2021. *Manning Agency Guidelines*. London: Marisec Publications for the International Chamber of Shipping. Retrieved from https://www.ics-shipping.org/wp-content/uploads/2021/09/Manning-Agency-Guidelines.pdf.

KOWASCH, M., 2017. Social and environmental transformations in the neighbourhood of a nickel mining project: A case study from northern New Caledonia. In C. Filer & P.-Y. Le Meur (Eds.), *Large-scale Mines and Local-level Politics: Between New Caledonia and Papua New Guinea* (pp. 99–131). Canberra: ANU Press. https://doi.org/10.22459/LMLP.10.2017.03.

KPCS (KIMBERLEY PROCESS CERTIFICATION SCHEME), 2003. KPCS Core Document. Retrieved from https://www.kimberleyprocess.com/en/system/files/documents/kpcs_document_en_0.pdf

LE MEUR, P.-Y., 2017. Conflict and agreement: the politics of nickel in Thio, New Caledonia. In C. Filer & P.-Y. Le Meur (Eds.), *Large-scale Mines and Local-level Politics: Between New Caledonia and Papua New Guinea* (pp. 157–182). ANU Press. https://doi.org/10.22459/LMLP.10.2017.05

LEVACHER, C., 2017. Contesting the Goro nickel mining project, New Caledonia: Indigenous rights, sustainable development and the land issue. In C. Filer & P.-Y. Le Meur (Eds.), *Large-scale Mines and Local-level Politics: Between New Caledonia and Papua New Guinea* (pp. 183–206. Canberra: ANU Press. https://doi.org/10.22459/LMLP.10.2017.06.

LNC, 2020, July 6. Kouaoua: que contient le protocole signé? *Les Nouvelles Calédoniennes*.

LNC, 2021, April 1. Vale a finalisé la cession de Vale Nouvelle-Calédonie à Prony Resources [‘Vale has completed the sale of Vale NC to Prony Resources’]. *Les Nouvelles Calédoniennes.*

LNC, 2021. October 14. Prony Resources et Tesla: le contrat est signé [‘Prony Resoucres and Tesla: the contract is signed’]. *Les Nouvelles Calédoniennes*.

LODHIA, S. AND HESS, N., 2014. Sustainability accounting and reporting in the mining industry: current literature and directions for future research. *Journal of Cleaner Production*, 84, pp.43-50. https://doi.org/10.1016/j.jclepro.2014.08.094

NSW DPI, 2017. *Biosecurity – National Livestock Identification System – Cattle*. Sydney: Department of Primary Industries. Retrieved from https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/723624/Procedure-NLIS-Cattle.pdf.

OWEN, J. R., & KEMP, D., 2019. Displaced by mine waste: The social consequences of industrial risk-taking. The Extractive Industries and Society, 6(2), 424–427. https://doi.org/10.1016/j.exis.2019.02.008.

OWEN, J., KEMP, D., L. MARAIS. 2021. The cost of mining benefits: Localising the resource curse hypothesis. Resources Policy, 74, 102289.

OXFAM, 2019. Buried treasure. The wealth Australian mining companies hide around the world. Melbourne: Oxfam Australia.

PAVÓN, S., 2018. *Animal identification and traceability in the European Union and international trade*. ICAR Technical Series No. 15. Utrecht: International Committee for Animal Recording. Retrieved from https://www.icar.org/index.php/publications-technical-materials/technical-series-and-proceedings/.

PORSCHE, 2021. September 15. BASF and Porsche partner to develop high-performing lithium-ion batteries for electric vehicles. Media release. Retrieved from https://www.porsche.com/international/aboutporsche/e-performance/magazine/basf-battery/.

RNZ, 2020, June 5. Unease grows in New Caledonia over Vale nickel plant sale. *RNZ Pacific.* Retrieved from https://www.rnz.co.nz/international/pacific-news/418346/unease-grows-in-new-caledonia-over-vale-nickel-plant-sale.

RYSTAD ENERGY, 2021, October 11. Nickel demand to outstrip supply by 2024, causing headaches for EV manufacturers. Press release. Retrieved from https://www.rystadenergy.com/newsevents/news/press-releases/nickel-demand-to-outstrip-supply-by-2024-causing-headaches-for-ev-manufacturers/

SINCLAIR, M., DERKLEY, T., FRYER, C., & PHILLIPS, C. J. C., 2018. Australian public opinions regarding the live export trade before and after an animal welfare media exposé. *Animals, 8*(7), 106. https://doi.org/10.3390/ani8070106.

STATISTA, 2021a, May. Renewable energy demand for nickel in worldwide in 2020, with forecast figures for 2030 and 2040, by sector and scenario. Retrieved from: https://www.statista.com/statistics/1258903/worldwide-nickel-demand-for-renwable-energy-by-sector-and-scenario/

STATISTA, 2021b. The world's leading importers of nickel and nickel products in 2020, by country. Retrieved from https://www.statista.com/statistics/1116992/global-nickel-imports-by-country/

TALBOT, D. AND BARBAT, G., 2020. Water disclosure in the mining sector: An assessment of the credibility of sustainability reports. *Corporate Social Responsibility and Environmental Management*, *27*(3), pp.1241-1251. https://doi.org/10.1002/csr.1880

UN GLOBAL COMPACT, 2015. *Guide to corporate sustainability*. New York: United Nations Global Compact.

VALE, 2010. *Annual Report*. Rio de Janeiro: Vale S.A.

VALKILA, J., 2009. Fair Trade organic coffee production in Nicaragua – Sustainable development or a poverty trap? *Ecological Economics, 68*(12), 3018–3025. https://doi.org/10.1016/j.ecolecon.2009.07.002.

WAR ON WANT, 2007. *Fanning the flames. The role of British mining companies in conflict and the violation of human rights.* London: War on Want

WORLD GOLD COUNCIL, 2012. *Conflict-Free Gold Standard*. London: World Gold Council. Retrieved from https://www.gold.org/about-gold/gold-supply/responsible-gold/conflict-free-gold-standard.