Strengthening ASEAN Cooperation in Minerals: Development Prospects of ASEAN Minerals Cooperation (DPAMC)

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The ASEAN Secretariat
Jakarta

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ASEAN: A Community of Opportunities for All

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Preface

The Study on the Development Prospects of ASEAN Minerals Cooperation (DPAMC) was commissioned by the ASEAN Secretariat, with financial support from the ASEAN-Australia Development Cooperation Program (AADCP) Phase II, as part of the project on *Strengthening ASEAN Cooperation in Minerals*. The project was conducted by the Sustainable Minerals Institute of the University of Queensland (UQ), Australia.

The objectives of the Study were to:

- Help define the future direction of ASEAN minerals cooperation and shape prioritisation of activities, as well as improve the effectiveness of cooperative efforts, by taking stock of ASEAN minerals development and cooperation in the context of global markets and minerals industry developments and making recommendations on future development priorities;
- Support incorporation of sustainable minerals development into all areas of minerals development and cooperation, by making recommendations in the light of regional and global minerals sustainability frameworks; and
- Inform the design of ASEAN Minerals Cooperation Action Plan (AMCAP-III) Phase 2, by proposing areas with highest potential for cooperation and proposing regional strategies and measures to pursue the study's recommendations.

In conducting the DPAMC Study, assessment and stock take of current ASEAN minerals development and cooperation in the context of global markets and minerals industry developments were conducted. In this light, recommendations about areas with highest potential for cooperation were made. The report also proposed revised regional strategies and measures to pursue the study's recommendations under AMCAP-III Phase 2.

The Study also included consideration of regional and global minerals sustainability frameworks, as well as recommendations on how sustainable minerals development can be incorporated into all areas of minerals cooperation.

The DPAMC study incorporated:

- Desk-based research and analysis;
- Consultation with stakeholders from minerals companies, industry bodies, non-government organisations, universities and research organisations, multilateral organisations and AMS governments; and,
- Multiple workshops with AMS representatives as a group and with ASEAN mineral working groups.

The Study was endorsed by the 21st ASEAN Senior Officials Meeting on Minerals (ASOMM) and welcomed by the 8th ASEAN Ministerial Meeting on Minerals (AMMin) held in October 2021.

The views and recommendations mentioned in this report do not necessarily represent those of the relevant agencies in the ASEAN Member States, ASEAN, ASEAN Secretariat and Australian Government nor impose any binding obligations on them.

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Executive Summary

This Report on Development Prospects for ASEAN Minerals Cooperation (DPAMC) is the result of research, analysis, consultation and stakeholder comment between October 2020 and August 2021. Stakeholders participating in consultations included representatives of ASEAN Member States (AMS) and the ASEAN Secretariat, mining associations in ASEAN, exploration and mining companies both operating within Member States and not currently operating in the region, ASEAN's dialogue and development partners, civil society organisations and other non-government organisations, and research organisations. This report has informed development and finalisation of the ASEAN Minerals Cooperation Action Plan (AMCAP-III) Phase 2. A parallel report to ASEAN makes recommendations on the future design of the ASEAN Mineral Database and Information System (AMDIS).

The minerals sector is a major economic contributor to ASEAN Member States (AMS), many of which are rich in mineral resources, as evidenced by past mineral resource discovery and current production. Demand for minerals within ASEAN and in other customer economies is expected to increase at the back of fast-recovering economic growth as the peak of the COVID-19 pandemic subsides. Growth in minerals use is expected to continue into the medium and long term, with demand in developing economies growing at a faster rate than developed economies.

At the same time, patterns of mineral demand will continue to shift. While demand for minerals used in traditional industries and end uses will continue to grow, driven by consumption, construction, manufacturing and agriculture, new demand is opening up, driven by the move to low emissions, renewable energy and energy storage, electrification of transport, digital technologies and the 4th Industrial Revolution. Fast-growing demand for critical minerals, and increased demand for traditional minerals such as copper, nickel, aluminium and tin, mark the biggest shift in minerals markets for many decades.

Strategic considerations have resulted in end-user industries, nations and groupings seeking to secure their supply chains of key and critical minerals. At the same time, consumer choice and government policies in customer nations are driving responsible sourcing of minerals and quality assurance of supply chains. These customer demands offer opportunities for supplier companies, nations, and groupings to expand mineral production, assure sources and build resilient supply chains.

The importance of securing supplies for a minerals intensive future – and the opportunities that greater minerals development can bring – are highlighted by the adoption of ASEAN's Priority Economic Deliverable (PED) 12 on *Responding to the Opportunities and Challenges of a Minerals-Intensive Future*, under the 2021 ASEAN Chairmanship of Brunei Darussalam.

Inevitably, AMS will also have to confront the challenge of 'complex orebodies', a term that refers to the complex and challenging contexts that companies and governments must face as high-grade orebodies become increasingly scarce globally.

If AMS can attract investment in all stages of the minerals value chain they will be well-placed to supply increased volumes of traditional minerals and additional types of mineral products being demanded by markets.

Against this are two negative indicators:

- ASEAN exploration data, which is showing both a loss of global market share of investment and less investment into grassroots exploration, with the trend extending for up to 10 years in some AMS; and
- Mining foreign direct investment data for ASEAN has shown a downward trend since 2014 and an outflow rather than inflow in 2018, albeit with some recovery in 2019.

Globally, exploration and mining investment has increased in the past five years (apart from the pandemic year of 2020), so the negative investment trends in ASEAN are concerning. The decline of early-stage exploration investment, in particular, will reduce the rate of discovery of new mineral resources required to

replace depleting reserves and resources as they are mined. This threatens the long-term future of mineral production within ASEAN and will limit the ability of AMS to meet emerging export opportunities. Further, the trend puts at risk the ability of AMS to supply raw materials and metals to their own fast-growing manufacturing and construction sectors.

A primary focus for AMCAP-III Phase 2 therefore is on building investment in all stages of the minerals value chain, commencing with exploration. Key to this is enhancing both geological and policy prospectivity. Not enough is known about the economic geology of much of the ASEAN region and existing data is often difficult for exploration investors to access. Moreover, ASEAN and its Member States have generally not marketed the region for exploration investment. The recommendations of this DPAMC report address, at high level, how to overcome these deficiencies.

Consultation with stakeholders also reveals deep-seated concerns about regulation, governance and sustainable minerals development as principal reasons that minerals investment is flowing to other destinations in preference to ASEAN. Policy, regulation and governance settings are generally perceived by both investors and NGOs as problematic, while risks are seen as high compared with other mineral investment destinations.

Turning the negative perceptions and investment trends around is a big challenge that will take time. There is a fundamental need for AMS to be demonstrably welcoming of minerals investment at all stages of the value chain, and to commit to implementing leading practice in all aspects of mining policy, regulation and governance, including sustainable minerals development.

Leading practices are evolving fast, however. These include responsible sourcing, the need for mineral supply security, the drive to reduce emissions from minerals supply chains, lowering environmental impacts and risks, and the imperative of achieving social licences to operate from host communities.

Many of the benchmarks have been set by leading minerals nations and minerals organisations elsewhere. This presents an opportunity for ASEAN to tap world-leading practices and adapt them to suit regional circumstances, while implementing continual improvement to keep up with evolving expectations.

To enable effective application of sound practice, there is an imperative for strong governance capability, not only within government, but also with the industry and community organisations. Therefore, the adoption of leading practices needs to be enabled by capacity-building across minerals stakeholder organisations to ensure that institutions and individuals are equipped to play their part in effective minerals governance.

Cooperation in minerals is a key component of a pan-ASEAN strategy that will enable AMS to work together to build minerals investment, grow the minerals sector, expand trade and ensure sustainable approaches to minerals development. AMCAP-III Phase 2 will activate and guide cooperation between AMS to achieve their goals in minerals, working with dialogue and development partners, the minerals industry, and civil society and other non-government organisations.

The recommendations in this report for enhanced ASEAN cooperation in minerals extend the current priorities, led by strategies for boosting investment, production and trade in minerals, driving sustainable minerals development, building capacity in minerals governance and providing high quality minerals information.

Recommendations

From consultation and analysis conducted, the following themes have been identified as having the highest potential for ASEAN cooperation in minerals. The findings of this study support continued prioritisation of existing AMCAP strategic focus areas, the implementation of which is overseen by the four ASEAN Minerals Working Groups:

- Boosting investment, production and trade in minerals
- Driving sustainable minerals development
- Building capacity in minerals governance
- Providing high quality minerals information.

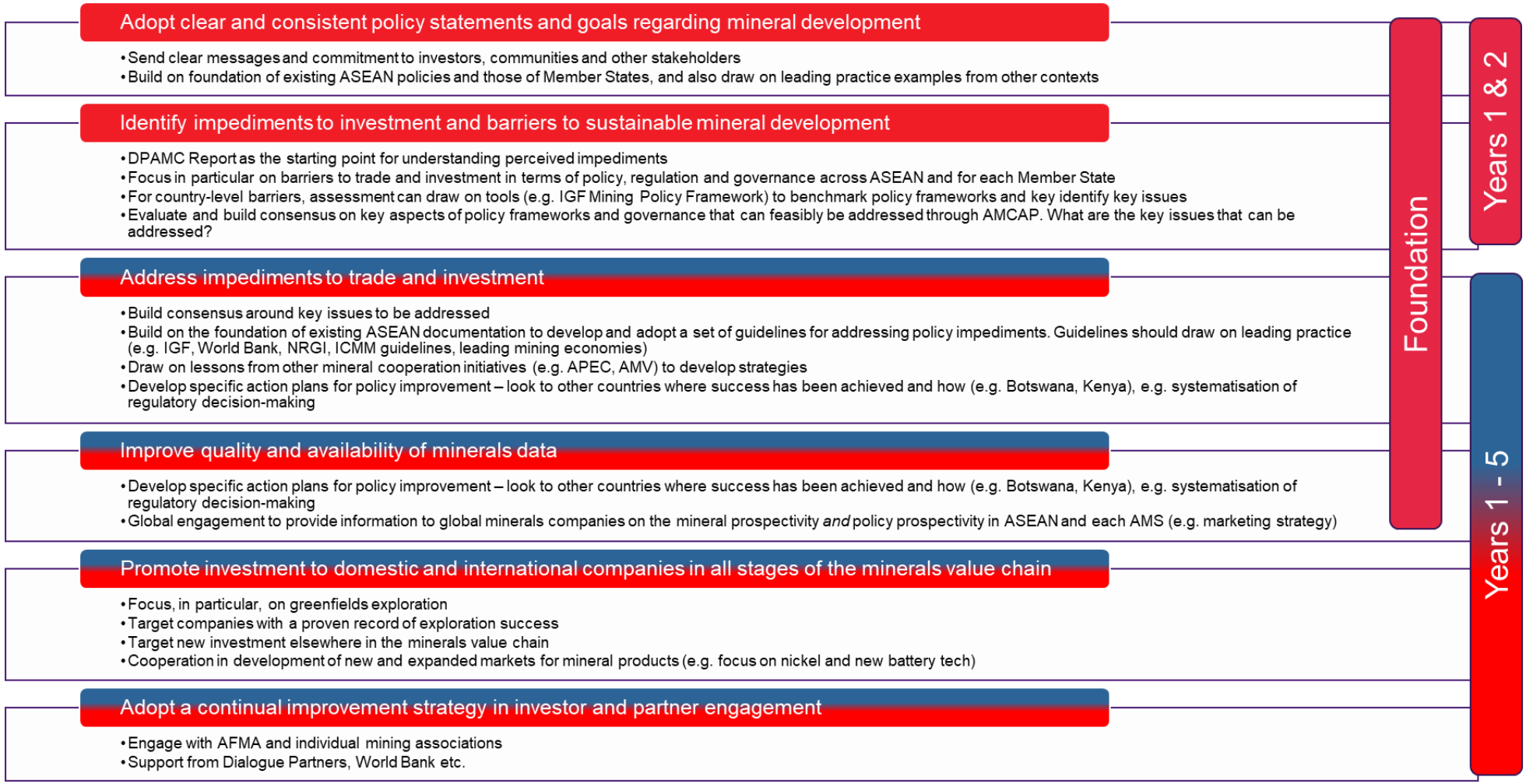
Recommended strategies have been identified under each of these headings, plus implementation measures. These recommendations apply to ASEAN as an organisation. Their effectiveness is of course dependent on both implementation by ASEAN and actions by ASEAN Member States that improve minerals policy, regulation and governance in their jurisdictions.

Graphical summaries of the recommendations for the first three focus areas are presented on the following pages. They include indicative timelines.

Detailed recommendations are then set out for the first three focus areas plus:

- High level recommendations for providing high quality minerals information
- Resetting AMCAP
- Strategies to ensure sustainability of project outcomes.

Boosting investment, production and trade in minerals



Driving sustainable minerals development

Building capacity in minerals governance

Boosting investment, production and trade in minerals

Objective

Reverse the current negative trend to increase domestic and international investment in all components of the minerals value chain across ASEAN Member States, and especially in greenfields exploration, to build the resource base and underpin mining and processing investment leading to greater production and trade.

Recommendations

ASEAN should:

1. Adopt clear and consistent policy statements and goals for minerals development and lead ASEAN Member States to do likewise. Policy statements should recognise the current and future importance of the minerals sector to economies, societies, the environment and sustainable development, be welcoming of investment and commit to high standards of mineral governance and to minerals development within sustainable development parameters.
    a. Policy statements and goals should send clear messages to investors, to communities, to sub-national governments, to bureaucracies, and to dialogue and development partners about ASEAN and its members states seeking to grow mineral production and value generation and welcoming investment in responsible mineral development.
    b. This effort should build on the foundation of existing ASEAN policies and those of Member States, plus should draw upon leading practice policies adopted by leading mineral producer nations, regional groupings, international agencies and industry-linked non-government organisations.
2. Lead ASEAN Member States to identify impediments to investment in minerals development and barriers to achieving sustainable development outcomes and assess options for prioritised, transparent and consistent approaches to overcome these obstacles.
    a. Utilise this DPAMC Report as a starting point for deep analysis of obstacles ASEAN-wide and country-by-country, and for identifying options for solutions.
    b. Focus in particular on barriers to investment and trade identified from consultation, including the number one issue of complex and inconsistent policy and regulation within and across ASEAN Member States.
    c. Adopt the recommendations of this report for enhanced cooperation in minerals governance, policy, sustainability and investment attraction, drawing on leading practices from other jurisdictions and regional and multilateral initiatives.
3. Lead ASEAN Member States to address impediments and adopt more consistent policies and regulations affecting mineral investment within and across ASEAN Member States, and that are aligned with global leading practice, including strengthened sustainable development policies and regulations (detailed further in the Sustainable Minerals Development recommendations) that create a stable and attractive environment for investments.
    a. Adopt the recommendations of this report for enhanced cooperation in minerals governance, policy, sustainability and investment attraction, drawing on leading practices from other jurisdictions and regional and multilateral initiatives.
    b. ASEAN should develop and adopt a set of leading practice guidelines for policies and regulation that are suitable for ASEAN and its Member States, and individual Member States should endorse and implement them.
    c. Guidelines should build on the foundation of existing ASEAN documentation, including the ASEAN Minerals Cooperation Action Plan and national frameworks of ASEAN Member States.

d. Guidelines should also draw upon the extensive range of leading practice guidelines produced by external organisations globally, including the World Bank, OECD, International Council on Mining and Metals, Mining Association of Canada, Minerals Council of Australia, and Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development.

4. Through the revamped ASEAN Mineral Database and Information System (AMDIS), improve the quality and availability of precompetitive geoscience data, plus mineral development and production data, to potential investors in exploration, and package and promote datasets to attract investment (see also recommendations on providing high quality minerals information).

    a. The AMDIS should have two additional purposes: to provide easily accessible and transparent information about minerals development, production and sustainability to the ASEAN and global public; and to provide a collaboration platform for agencies within ASEAN Member States and ASEAN itself.

5. Provided ASEAN and its Member States have embarked on the recommended policy and practice journey, lead engagement with mining associations and minerals companies globally to provide comprehensive, consistent and readily available information to global minerals companies on the mineral prospectivity and investment environment for minerals across ASEAN and within each ASEAN Member State.

    a. ASEAN should develop and promulgate a marketing strategy, potentially including global roadshows and conference participation, visits by major investors to the region, an annual minerals conference targeting investors, and a state of the art AMDIS platform with associated quality data.

6. Provided ASEAN and its Member States have embarked on the recommended policy and practice journey, actively promote investment to domestic and international companies in all stages of the minerals value chain, with a particular focus on greenfields exploration, so as to expand the resource base to underpin long-term mining and processing investment.

    a. ASEAN and its Member States must focus on achieving much increased and successful greenfields (or 'grassroots') exploration, which is required to reverse a 10-year trend of decline in expenditure so as to discover new resources necessary to replace known resources and reserves that are inevitably being depleted though mining.

    b. ASEAN and its Member States must target both larger and smaller companies, particularly those with a proven record of exploration success, to entice them back to the ASEAN region from which many have departed their exploration presence.

    c. New investment elsewhere in the minerals value chain should also be targeted, particularly investment that generates increased minerals production, and that demonstrably adds value through downstream processing, technology and skills diffusion and local provision of mining equipment, technology and services.

    d. Pursue cooperation in development of new and expanded markets for mineral products to grow ASEAN output and market share, taking advantage of shifts in demand for both new and traditional commodities and manufactured products, and addressing customer requirements for sustainably produced minerals and mineral products.

7. Adopt a continual improvement strategy in investor and partner engagement, including closer linkages with mining associations and companies, and collaboration with dialogue partners so as to promote investment and adoption of leading practices, and to build governance capacity.

    a. The ASEAN Federation of Mining Associations and member mining associations are potentially powerful partners in linking with mining companies, identifying impediments, implementing solutions, promoting investment and advocating sustainable minerals development, and therefore must be closely engaged by ASEAN and governments.

b. Current and potential dialogue partners, which can offer multi-faceted support to ASEAN, must also be engaged closely, including government agencies in prominent mining and customer nations, multilateral organisations such as the World Bank and APEC, civil society organisations and global business associations with minerals policy interests.

c. Engagement of customer nations and groupings to build strong relationships and assured supply chains, particularly to build ASEAN-produced minerals as key components of the energy and economic transitions that are now underway.

Driving sustainable minerals development

Objective

ASEAN and its Member States, sub-national governments, investors in minerals and non-government organisations adopt sustainable minerals development principles and implement leading practices to progressively improve governance, and economic, social and environmental outcomes.

Recommendations

ASEAN should:

1. Establish a dialogue with and between ASEAN Member States, sub-national governments, investors in minerals and non-government and civil society organisations to engage them and build support for sustainable minerals development policies, objectives, principles and practices.

    a. The dialogue might chart a long-term vision and strategy as an ASEAN Mining Vision, modelled on the Africa Mining Vision.

    b. It is important that support for adoption of sustainable mineral development approaches is broad-based and that stakeholders have shared objectives and principles, as well as commitments to leading practices, so ASEAN facilitation of joint dialogue is needed to achieve successful outcomes.

    c. Dialogue partners can assist with design and facilitation of effective stakeholder engagement.

    d. The process of dialogue and the articulation of a vision will provide a point of reference for harmonisation and, in and of itself, signal to companies and investors that ASEAN is interested in a stronger sector and is taking steps toward more effective governance.

    e. Invite the architects of the Africa Mining Vision, principally from the United Nations Economic Commission for Africa, to brief ASEAN member states on the journey of the vision and the transferability to Asia.

2. Develop and adopt a set of principles for sustainable minerals development across ASEAN Member States to underpin progressive adoption of a more comprehensive SMD framework and an ASEAN Mining Vision.

    a. To be effective, principles must be supported not only by ASEAN Member States but also endorsed by other stakeholders, so the dialogue process to develop them needs to be inclusive, as does the ongoing dialogue to support the more detailed SMD framework.

    b. SMD principles and the eventual framework should draw on the number of similar documents adopted in other jurisdictions and industry bodies, seeking out leading practices and adapting for ASEAN.

    c. Achieving the goals outlined in any new ASEAN SMD principles would be aspirational and involve AMS committing to make continuous improvement towards these, rather than setting an end date for achieving them.

3. Build greater understanding of, and support for SMD policies and practices within ASEAN Member States, including the close linkages to attracting leading practice investors across the minerals value chain.
    a. A series of workshops with AMS representatives, led by WGSMD, could be the starting point, building on the objectives of AMCAP and ASEAN Reporting Mechanism on sustainable frameworks and tools for the minerals sector.
    b. Mineral associations, international mineral organisations and progressive companies (both from and outside of ASEAN) should be at the forefront of this advocacy, so as to demonstrate the importance of sound and effective SMD policies in attracting investment from leading practice investors.
4. Work with dialogue partners to adapt existing leading practice SMD frameworks from other regions, nations and industry to suit ASEAN and Member States, for progressive adoption.
    a. ASEAN should develop and adopt a set of leading practice guidelines for SMD that are suitable for ASEAN and its Member States, and individual Member States should endorse and implement them progressively.
    b. Guidelines should build on the foundation of existing ASEAN documentation including ASEAN Minerals Cooperation Action Plan; Sustainable Practice in Minerals Development: Best Practices in ASEAN; ASEAN Reporting Mechanism (RM) to Monitor the Adoption of Sustainability Assessment Frameworks and Tools for the Minerals Sector; and national frameworks of ASEAN Member States.
    c. Guidelines should also draw upon the extensive range of leading practice of guidelines produced by external organisations globally, including the World Bank, OECD, International Council on Mining and Metals, Mining Association of Canada, and Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development.
    d. ASEAN will find ready willingness from dialogue partners and industry to assist in development of an SMD framework.
5. Design and adopt non-financial incentives that can be used by ASEAN and within ASEAN Member States to promote and encourage adoption of SMD amongst minerals associations, minerals companies, financiers and NGOs.
    a. Such incentives should be designed to reward companies that embrace SMD policies and practices and perform to high standards and encourage others to do so.
    b. Incentives can range from awards to companies and jurisdictions and other recognition for excellence in SMD practice (as currently), through to giving high performing companies advanced standing in approvals processes for new or expanded projects to simplify and accelerate assessment and approvals processes without compromising outcomes.
6. Commission knowledge-sharing and capacity-building activities to assist governments, industry participants and NGOs to build their knowledge of new issues (such as managing complex ore bodies and mining waste) and continually emerging leading practices in SMD.
    a. Several existing organisations and platforms dedicated to SMD could be tapped to provide or support such activities, and such organisations (including existing dialogue partners) have indicated willingness to assist.
7. Build-in continual improvement to the SMD principles and framework to actively seek out and adopt new approaches and technologies, monitor, evaluate, research, and learn (MERL) from outcomes and impacts.

a. ASEAN should implement a MERL process, with regular reporting, to both assess effectiveness and provide incentives for sustainability performance.

b. Design and implementation of the MERL process could be commissioned from an outside organisation with experience in this filed and in applying it to the minerals sector.

c. SMD is a constantly evolving process, with the boundaries of leading practice shifting, so it is important to build-in a MERL process to both assess effectiveness, develop new approaches and adaptively manage.

Building capacity in minerals governance

Objective

Build human, institutional, and technical capacities in minerals governance[1] in the ASEAN Minerals Sector so as to achieve increased investment, greater output and trade in minerals and mineral products, and strongly positive economic, societal and environmental outcomes.

Recommendations

ASEAN should:

1. Design and implement a comprehensive capacity-building program for ASEAN Member States, sub-national governments, universities and training institutions, NGOs, mineral industry organisations and minerals companies operating in AMS across priority aspects of minerals governance, including leading practice regulation, transparent and efficient approval processes, application of SMD principles and practices, inclusive community engagement, occupational and community health and safety, and value optimisation for host nations and sub-national regions.

    a. There are several existing or recent capacity-building programs in minerals governance that can be drawn on in designing and implementing the ASEAN program, including those operated by Australia, Canada, the EU and UK, IGF and the World Bank.

    b. Experience has shown that some of the most effective capacity-building is delivered through short courses combined with study tour, underpinned by proven pedagogical approaches to ensure both effective learning and application of learning on return to work. Previous study tours under initiatives such as IM4DC to countries such as Australia and Canada have proven particularly effective in enhancing government's understanding of the importance of clear, consistent, easily understood and predictable policy frameworks. This may create momentum for change within AMS, particularly if senior mining officials, industry and civil society are involved.

    c. Capacity building might also usefully include assembling an atlas of mining legislation and regulation in the ASEAN region, modelled on the African Mining Legislation Atlas implemented by the African Union and World Bank. The atlas could include a guiding template of potential legal provisions for regulating various issues of importance to the region, which would also assist in the gradual harmonisation of laws over time.

2. Develop a knowledge management platform to support governance learning within ASEAN amongst stakeholders, share information, and report on outcomes and impacts.

    a. Experience has shown, however, that knowledge management platforms are only effective and sustainable when operated as part of an ongoing capacity-building activity, with knowledge management platforms on their own likely to become non-current, fall into disuse or both.

[1] For a definition and description of minerals governance, see box on page 15.

b. There are several existing minerals knowledge management platforms of varying currency that could provide some guidance for how ASEAN could establish its platform, which could be hosted by the revised AMDIS platform.

3. Work with Member States to improve the knowledge, oversight and governance of the construction materials and industrial minerals, critical to the development of the ASEAN region.

   a. Construction materials and industrial minerals provide critical inputs for domestic and regional economic development, represent the majority of mineral production in most countries, and employ large numbers of people. Oversight and support of the sector, however, is often lacking and ASEAN Member States may wish to assign dedicated units within their regulatory agencies to manage this important sector.

   b. ASEAN could explore the potential for a capacity building program for member states with the United Nations Development Program (UNDP), aligned to the existing OACPS-EU Development Minerals Programme that is implemented by UNDP.

4. Further develop and facilitate networking, collaboration and knowledge exchange in key aspects of the minerals value chain and SMD, including technologies and leading practices.

   a. This should occur both within ASEAN and in collaboration with dialogue partners to maximise depth of knowledge and experience

5. Establish a network of universities and training institutions working on mineral governance issues, and build their capacity in teaching and learning, research and development, through collaboration within and outside ASEAN.

   a. Universities and TVET colleges are vital parts of mineral development infrastructure, providing the education, training and professional development required to develop and maintain the skills required for both the minerals workforce and to enable quality minerals governance.

   b. There is limited and variable capacity of universities and TVET colleges across ASEAN to conduct high quality mineral education and training and this provides an excellent opportunity for cooperation to build both education and training capacity and to share education and training resources, potentially in collaboration with institutions outside ASEAN.

6. Engage with Dialogue Partners and other international organisations to support initiatives in trade and development, SDM and capacity-building.

   a. Initial discussions with Dialogue Partners and other organisations outside ASEAN indicate ready willingness to support implementation of the next phase of AMCAP.

   b. Current and potential partner organisations should continue to be engaged during design of AMCAP-III Phase 2 in order to reach early agreement on cooperation arrangements and build these into the design.

   c. Partner with and reinvigorate the APEC Services Trade Access Requirements (STAR) Database with updated information and expanded coverage to Myanmar, Cambodia and Lao PDR. The STAR database assists to disseminate information on the regulatory and business environment to companies and investors.

7. Implement a logic framework and an associated monitoring, evaluation, research and learning (MERL) program to design the AMCAP program and to monitor outcomes and impacts and inform continuous improvement in AMCAP activities.

   a. AMCAP-III Phase 2 should be underpinned by a clear ‘theory of change’ or program logic to provide clear linkages between objectives, activities, outputs, outcomes, and long-term impacts.

b. A MERL process is needed to measure performance, assess effectiveness, review approaches, and adaptively manage the AMCAP implementation.

8. Broaden sources of funding and technical resources, from both within and outside ASEAN and secure these to sustain implementation.

   a. There are clear linkages between effective minerals governance and the economic, social and environmental outcomes from minerals development. Therefore greater investment by ASEAN member States and industry will result in positive benefits to all stakeholders, both financial and non-financial.

   b. Failure to apply adequate resources is highly likely to result in outcomes falling short of aspirations.

Providing high quality minerals information

Objective

Redesign the ASEAN Minerals Database Information System to:

- Enhance ASEAN cooperation in Minerals Development by enabling implementation of the AMCAP and facilitating ASOMM collaboration.
- Provide information and minerals-industry specific data that will drive investment in minerals development, including exploration and foreign direct investment, into the ASEAN region.
- Provide information about the ASEAN minerals industry, minerals development in the region, research, capacity building, environmental and community aspects to enhance transparency and provide a driver for improved sector performance.

Recommendations

1. As detailed in the AMDIS Scoping Report, adopt a three-platform design for AMDIS:

   a. A **Landing Page** open to the public, which provides general information, an infographic with selected trade and investment statistics relevant to investors and the public, and links from which a wide range of information can be accessed, including the WebGIS and AMCAP Online Collaboration Platform (AOCP).

   b. A **WebGIS**, open to the public, which includes geoscientific information, including geological mapping, geological interpretation, mineral prospectivity interpretation (where available), mineral occurrences and resources, any available geochemistry, geophysics, and infrastructure mapping.

   c. An **AMCAP Online Collaboration Platform** (AOCP) available only by secure login to delegated authorities from ASEAN for sharing information and managing the implementation of the AMCAP, which would include the detailed trade and investment statistics that are currently resident within the AMDIS and are primarily used for policy, cooperation and monitoring purposes.

2. Consider options for implementing and hosting the AMDIS, or components of it, including: outsourcing to an external organisation; ongoing in-house utilising the capabilities of an ASEAN Member State; and collaboration with an external partner.

3. Foster industry support for greater investment in the generation of public-good and publicly available geological data.

   a. Initiate discussions with AMIRA Global about the potential for an ASEAN Exploration Initiative, modelled on the West African and South American Exploration Initiatives that have mobilised significant private sector support and investment for geological data generation and mapping.

Resetting AMCAP

Objective

Guide, support and facilitate ASEAN and its Member States to attract minerals investment, and achieve positive economic, social and environmental outcomes through increased minerals production and trade across the value chain, underpinned by efficient and effective governance, cooperation and capacity to achieve sustainable mineral development in the region.

Recommendations

ASEAN should:

1. Prioritise and rationalise AMCAP programs and activities to ensure rapid execution and delivery of outputs and outcomes.
2. Focus on attraction of investment from leading practice exploration and mining companies so as to increase rates of minerals discovery to provide the resources for a growing minerals sector and expand trade and activities throughout the minerals value chain.
3. Expand activities related to sustainable minerals development to promote SMD, build SMD capacity in AMS, the minerals industry and civil society, and achieve better SMD outcomes.
4. Cooperate and share knowledge with other regional and sub-regional cooperation frameworks active in the ASEAN region and elsewhere, plus Development and Dialogue Partners, to build mineral governance capacity across ASEAN Member States.
5. Seek other funding opportunities, such as co-funding and in-kind contributions, from host countries and/or Development and Dialogue Partners so as to build on and leverage funding from the ASEAN Minerals Trust Fund.
6. Create a monitoring, evaluation, research and learning mechanism to measure outputs, outcomes and impacts, and progress towards objectives, and provide information for continuous improvement of AMCAP.

Strategies to ensure sustainability of project outcomes

Objective

Ensure that the recommendations of this report are implemented in a timely way, result in ASEAN and AMS measurably moving towards achieving objectives of AMCAP, and lift trade and investment in minerals while achieving more sustainable outcomes from minerals development.

Recommendations

ASEAN should:

1. Work to achieve commitment from all AMS to implement the accepted recommendations and incorporate in the revised AMCAP.
2. Establish a dedicated unit (e.g. located at a regional university) with permanent staffing to help implement the AMCAP, drawing on models such the African Mineral Development Centre.
3. Establish and execute a time-bound implementation plan for the revised AMCAP, with regular reporting of actions and outputs.
4. Establish a rigorous logic framework to set outputs, outcomes and impacts against objectives and measure through a MERL process.

5. Review the implementation plan periodically against progress measured though the MERL and adjust the plan as required.
6. Engage a wide cohort of stakeholders (e.g. industry, CSOs/NGOs, development partners) to support and play differentiated roles in implementation.
7. Report regularly and publicly on the implementation of AMCAP and the outcomes and impacts.
8. Develop a new funding strategy for AMCAP implementation with the aim of mobilising funds from AMS, the private sector, and Dialogue Partners.

What is minerals governance?

Minerals governance can be defined as:

The necessary blend of (1) law and regulation; (2) government administration, monitoring and enforcement; (3) community engagement; and (4) voluntary private sector practices that enables:

- Governments to host responsible private sector investment in mining
- Mining to be conducted sustainably
- Benefits to be delivered to nations and regions, their economies, and their communities
- Investors to derive commercial returns.

Stakeholders include national and regional governments, domestic and foreign owned mining companies, civil society organisations, industry associations, and education and research institutions.

Minerals governance encompass interactions of stakeholders throughout the mining lifecycle – from investment policy, precompetitive exploration data collection and tenement administration; to mining approvals and regulation, revenues, monitoring and external impacts; to mines closure, post mining land use and post mining economic activity.

Nations that host well-governed minerals sectors tend to:

- Attract investment of higher quality and value
- Achieve better financial returns
- Achieve better economic, social, and environmental outcomes.

This is because their risk profile is significantly reduced – sovereign risk, regulatory risk, financial risk, and social licence risk. As well, such countries have policies and mechanisms that enable local businesses and communities to connect with mining activities to derive economic and social benefits, while mitigating detrimental impacts.

Source: International Mining for Development Centre (2013), Annual Plan 2013-14, International Mining for Development Centre, Perth

Acronyms

Acronym	Definition
AfDB	The African Development Bank
AFMA	ASEAN Federation of Mining Associations
AMCAP	ASEAN Minerals Cooperation Action Plan
AMDC	African Mineral Development Centre
AMDIS	ASEAN Minerals Database and Information System
AMFG	African Mineral Governance Framework
AMGC	African Minerals and Geo-Sciences Centre
AMIRA	Australian Mineral Industries Research Association
AMLA	African Mining Legislation Atlas
AMMin	ASEAN Ministerial Meeting on Minerals
AMS	ASEAN Member States
AMTF	ASEAN Minerals Trust Fund
AMV	Africa Mining Vision
AOCP	AMCAP Online Collaboration Platform
APEC	Asia Pacific Economic Cooperation
ARC	Australian Research Council
ASEAN	Association of Southeast Asian Nations
ASEC	ASEAN Secretariat
ASGMI	The Association of Iberoamerican Geological and Mining Surveys
ASM	Artisanal and small scale mining
ASOMM	ASEAN Senior Officials Meeting on Minerals
AU	African Union
AU-ACS	African Union African Commodities Strategy
AUC	African Union Commission
AusAID	Australian Agency for International Development
AusIMM	The Australasian Institute of Mining and Metallurgy
BEPS	(Tax) base erosion and profit shifting
BPMPI	Best Practices Mineral Potential Index
CAHRAs	Conflict-affected and high-risk areas
CARICOM	Caribbean Community
CIDP	Canadian International Development Platform
CIRDI	Canadian International Resources and Development Institute
CIRDI-SUMM	Supporting the Ministry of Mines Ethiopia
CMMI	Critical Minerals Mapping Initiative
CMV	Country Mining Visions
CONNEX	G7 CONNEX Initiative on support for negotiation of contracts in the extractive sector
COVID-19	Coronavirus disease of 2019
CSO	Civil society organisation

Acronym	Definition
CSR	Corporate social responsibility
DFAT	Australia Department of Foreign Affairs and Trade
DPAMC	Development prospects of ASEAN minerals cooperation
ECOWAS	Economic Community of West African States
EGP	Environmental Governance Project for Sustainable Natural Resource Management Programme
EGS-OAGS	EuroGeoSurveys-Organisation of African Geological Surveys
EITI	Extractive Industries Transparency Initiative
ASEC - EMD	ASEC Energy and Minerals Division
EMDP	ECOWAS Mineral Development Policy
EPRM	European Partnership for Responsible Minerals
ESG	Environmental, Social and Governance
EU	European Union
EU-LA-MDNP	EU-Latin America Mineral Development Network Platform
FC	Facilitation Committee
FDI	Foreign Direct Investment
FORAM	Towards a World Forum on Raw Materials
FPIC	Free, prior and informed consent
GDP	Gross domestic product
GEF	Global Environment Facility
GIRAF	Geoscience Information in Africa
GSD	Geoscience Division of the Pacific Community
ICMM	International Council on Mining and Metals
IDEAS	Institute for Democracy and Economic Affairs
IFC	International Finance Corporation
IGCP	UNESCO-International Geoscience Programme
IGF	Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development
ILO 169	International Labour Organization Convention 169
IM4DC	International Mining for Development Centre
IMA	Indonesian Mining Association
IMF	International Monetary Fund
ISR	Institute of Essential Services Reform
JICA	Japan International Cooperation Agency-Energy and Mining Group
JOGMEC	Japan Oil, Gas and Metals National Corporation
LME	London Metals Exchange
MDNP	EU-Latin America Mineral Development Network Platform
MERL	Monitor, evaluate, research and learn
METI	Japan's Ministry of Economy, Trade and Industry
METS	Mining equipment, technology and services
MMSD	Mining, Minerals and Sustainable Development

Acronym	Definition
MoMP	Ethiopian Ministry of Mines and Petroleum
MRM	Ministers Responsible for Mining
MTF	Mining Task Force
MTR	Mid Term Review
NGO	Non-government organisation
NR4D	Natural Resource for Development
NRBD	Natural Resource-Based Development
NRGI	Natural Resource Governance Institute
OACPS-EU-DM	OACPS-EU Development Minerals Programme
OAGS	Organisation of African Geological Surveys
OECD	Organisation for Economic Co-operation and Development
PanAfGeo	Pan-African Support to the EuroGeoSurveys-Organisation of African Geological Surveys (EGS-OAGS) Partnership
PEV	Plug-in electric vehicles
PhD	Doctor of Philosophy
PNG	Papua New Guinea
POPs	Persistent organic pollutants
PPDM	Public-Private Dialogue on Mining
PPI	Policy Perception Index
PS	Performance Standards
Q	Quarter
R&D	Research and development
R&D&I	Research and development and innovation
REE	Rare earth elements
RM	Reporting Mechanism
S&P	Standard & Poor's Global Market Intelligence
SADC	Southern African Development Community
SAXI	South African Exploration Initiative
SDGs	Sustainable Development Goals
SDM	Sustainable minerals development
SEPA	The Swedish Environmental Protection Agency
SIA	Social impact assessment
SMD	Sustainable minerals development
SMEs	Small and medium enterprises
SPC	Pacific Community
STAR	APECs Services Trade Access Requirements database
SWOT	Strengths, weaknesses, opportunities and threats
TVET	Technical and Vocational Education and Training
UEMOA	West African Economic and Monetary Union
UK	United Kingdom
UN	United Nations

Acronym	Definition
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UQ	The University of Queensland
UQID	University of Queensland International Development
USA	United States of America
USD	United States dollars
USGS	United States Geological Survey
WAMEU	West African Monetary and Economic Union
WAXI	West African Exploration Initiative
WBG	World Bank Group
WebGIS	Web based geographic information system
WEF	World Economic Forum
WGSMD	Working Group on Sustainable Mineral Development

Glossary of terms

Term	Definition
Prospectivity	The likelihood of minerals discovery in grades and quantities that can be developed into commercially viable mining operations
Geological prospectivity	The geological conditions required to underpin the likelihood of discovery of commercial mineral resources and reserves
Policy prospectivity	The policy, legislative and governance conditions required to support exploration and development of discoveries into commercially viable mining operations
Greenfields exploration	The term applied to exploration in locations where mining operations have not yet been established
Grassroots exploration	The term applied to exploration, often in greenfields locations, that commences with basic mapping and geological assessment
Late stage and feasibility exploration	Terms applied to exploration that has reached an advanced stage of defining resources and reserves and/or underpinning feasibility assessment of establishing mining operations
Minesite exploration	The term applied to exploration on established minesites aimed at extending defined ore bodies and/or increasing reserves, generally to increase mine life or expand output
Precompetitive exploration	Early-stage exploration undertaken by governments, sometimes in partnership with research organisations and the private sector, to generate basic geological, geophysical and geochemical information and data packages aimed at attracting private sector investment in exploration
Minerals governance	See definition on pages 15

Chapter 1: Introduction and report overview

1.1 Strengthening ASEAN Cooperation in Minerals project

1.1.1 Overview

The ASEAN Secretariat appointed the University of Queensland (UQ) to conduct the *Strengthening ASEAN Cooperation in Minerals* consultancy in two components: 1. Study on the Development Prospects of ASEAN Minerals Cooperation (DPAMC) (the subject of this public report); and 2. Scoping and analysis to design an enhanced ASEAN Minerals Database and Information System (AMDIS) (with a report provided for use internally to ASEAN).

The Sustainable Minerals Institute of UQ worked with several external experts and in close liaison with the Energy and Minerals Division of the ASEAN Secretariat to deliver both components in a staged process during late 2020 and much of 2021.

The report on DPAMC has helped define the future direction of ASEAN minerals cooperation and shape prioritisation of activities, as well as improve the effectiveness of cooperative efforts. The report has been a key input to design of ASEAN Minerals Cooperation Action Plan (AMCAP-III) Phase 2, that builds on Phase 1. Together with delivery of an enhanced mineral database and information system, AMCAP-III Phase 2 will seek to further enhance ASEAN minerals sector dynamism with revitalised strategies and new initiatives towards boosting trade and investment, closer cooperation, and strengthening capacity in sustainable minerals development for a more prosperous and integrated ASEAN.

The minerals sector is a major economic contributor to ASEAN Member States (AMS), many of which are rich in mineral resources. In 2018, two-way minerals trade, both intra-ASEAN and extra-ASEAN, grew by 9 per cent year-on-year. Minerals trade was valued at USD249.8 billion and accounted for 8.9 per cent of ASEAN's total trade.

The demand for minerals within ASEAN and in customer economies elsewhere is expected to increase at the back of continuing regional and global economic growth and major shifts in minerals applications, led by transition to low-carbon energy sources. AMS are well-placed to attract investment in the minerals value chain and supply increased volumes of minerals and processed mineral products to customers within ASEAN and beyond. There is high potential for discovery of new mineral resources within AMS if exploration investment is increased.

Against this are two negative indicators. ASEAN exploration data is showing a loss of global market share of investment and less investment into grassroots exploration, while mining foreign direct investment data has shown a downward trend since 2014 and an outflow rather than inflow in 2018, albeit with some recovery in 2019.

Cooperation in minerals is a key component of a strategy that will enable AMS to work together to build minerals investment, grow the minerals sector, expand trade, and ensure sustainable outcomes from minerals development.

1.1.2 This report

This public report sets out a summary of findings and recommendations of the DPAMC study. It is a condensed version of the large (internal) DPAMC report presented to ASEAN minerals ministers in October 2021. The report is the result of research, analysis and consultation conducted between October 2020 and August 2021. Stakeholders participating in consultations have included representatives of ASEAN Member States and the ASEAN Secretariat, mining associations in ASEAN, exploration and mining companies both operating within Member States and not currently operating in the region, ASEAN's dialogue and development partners, civil society organisations and other non-government organisations, and research

organisations. A series of presentations have been made and several workshops have been conducted with representatives of AMS to discuss the findings and recommendations of this study and to obtain feedback.

1.1.3 AMCAP-III Phase 1

ASEAN Minerals Cooperation Action Plan (AMCAP-III) Phase 1 guided ASEAN minerals development cooperation from 2016. AMCAP-III Phase 1: 2016-2020 had the mission to "*create a vibrant and competitive ASEAN mineral sector for the well-being of the ASEAN people through enhancing trade and investment and strengthening cooperation and capacity for sustainable mineral development in the region*". It sought to achieve this with four key strategies:

- **Facilitating and enhancing trade and investment in minerals.** For example, by information sharing on minerals potential, marketing of opportunities, and reducing investment impediments.
- **Promoting environmentally and socially sustainable mineral development.** For example, by implementing sustainability assessment frameworks and guidelines, promoting sustainable practices, and knowledge exchange.
- **Strengthening institutional and human capacities in the ASEAN minerals sector.** For example, by presenting training courses, scientific collaboration, and exchanging knowledge and technology.
- **Maintaining an efficient and up-to-date ASEAN minerals database.** For example, cooperating in regular data updates, presenting training courses and exchanging experts.

Through programs, actions and outputs detailed in its implementation plan, AMCAP-III Phase 1 was activated and its delivery monitored.

The mission and strategies appeared appropriate for Phase 1, and with modification, underpin Phase 2. Phase 1 of AMCAP-III, however, is now viewed shall be enhanced to deliver the outputs and outcomes that the member states desire. The findings of this report and its recommendations provide guidance for the design and delivery of AMCAP-III Phase 2.

In addition, many internal and external factors have changed since 2016. ASEAN economies have gained experience in cooperation, attracting minerals investment and benefiting from minerals development. Minerals markets and investment patterns have changed, as have goals for sustainable development and standards for environmental, social and governance performance. This report discusses the major changes relating to the aims of AMCAP and makes recommendations to respond to them.

1.1.4 Design of AMCAP III – Phase 2

AMCAP-III Phase 2 will seek to advance its mission by further enhancing ASEAN mineral sector dynamism with revitalised strategies and new initiatives towards boosting trade and investments, closer cooperation, and strengthening capacity in sustainable mineral development for a more prosperous and integrated ASEAN. This project is intended by ASEAN to lead to:

1. Adoption of a new AMCAP-III Phase 2: 2021-2025; and
2. Delivery of a well-maintained and up-to-date minerals database and information system, AMDIS.

1.1.5 Approach to assessment of Development Prospects for ASEAN Minerals Cooperation

The study that feeds into this report examines all relevant developments in investment and trade, cooperation initiatives globally, and leading practice approaches to sustainability, in addition to the experience and views of stakeholders from government, the mining industry, civil society organisations and development partners.

In conducting the DPAMC Study, assessment and stock take of current ASEAN minerals development and cooperation in the context of global markets and minerals industry developments were conducted. In this light, recommendations about areas with highest potential for cooperation were produced. These include revised regional strategies and measures to pursue the study's recommendations under AMCAP-III Phase 2.

An important addition to AMCAP-III Phase 2 will be a strategy and programme area to further promote sustainable development of mineral resources, though adoption of an ASEAN sustainable minerals development framework. The DPAMC study, therefore included consideration of regional and global minerals sustainability frameworks. The report makes recommendations on how sustainable minerals development can be incorporated into all areas of minerals cooperation.

Chapter 2: Stocktake of ASEAN minerals development and cooperation

Key findings

- Several ASEAN Member States have a long history of minerals production, while others are emerging as producers. Two, Brunei Darussalam and Singapore, have roles as minerals processors and/or service hubs. Most are judged as prospective for minerals that are forecast to be in demand in the future, including critical minerals. Given future exploration success, ASEAN Member States should become growing producers and processors of minerals for customers within ASEAN and globally.
- Global demand and prices for minerals have more than recovered from the short-term shock of COVID-19 responses and are expected to continue to grow. Rising consumer demand, carbon reduction policies, energy transition and the "Fourth Industrial Revolution" of digital technologies are already changing demand, with critical minerals consumption rising rapidly. Use of cross-cutting minerals such as copper, zinc and aluminium is also rising. At the same time, construction of infrastructure will drive demand for construction materials close to market, while domestic consumption of other development minerals is also expected to rise.
- While ASEAN's mineral potential and market indicators are positive, recent ASEAN performance in attracting investment, particularly in greenfields exploration, has been poor. Exploration has declined in real terms and relative to a rise global spending. Mineral investors are prioritising regions other than ASEAN. This trend needs to be reversed to enable the minerals sector to grow towards its potential and contribute more to economic growth of ASEAN Member States.
- Key requirements of government are to implement positive policies for minerals development, address complex regulation, taxation and royalties settings, drive greater sustainability in minerals development, and build governance capacity. Improving availability of quality geological data, and supporting mining and processing operations to gain community support, are also primary needs. On this latter need, responsible minerals investors are embracing sustainability and ESG practices and seek out destinations that support these.
- Closer engagement with the minerals industry at home and abroad is needed to market the ASEAN region to investors. Much exploration investment has shifted away from ASEAN and to other regions. While reasons are complex and must be addressed by ASEAN and each AMS, part of the remedy is to communicate with investors more effectively about mineral prospectivity and about pro-investment changes to regulatory, sustainability and governance settings that improve policy prospectivity.

2.1 Chapter overview

This chapter reports on a stock-take of existing ASEAN minerals development and cooperation in the context of global markets and mineral industry developments discussed in Chapter 3. This stock-take has been compiled as a desktop exercise, including use of information provided by AMS. The stock-take includes:

- A review of the global context and state of ASEAN minerals development, including investment and exploration performance;
- Mapping of stakeholders in the minerals development space in ASEAN and those relevant to be engaged in this study; and
- A review of international experience on successful regional cooperation in minerals development that may be relevant to the ASEAN context (detailed in Chapter 4).

2.2 Changing global context

AMCAP-III Phase 1 guided ASEAN minerals development cooperation from 2016. Many factors have changed since then, emerging ASEAN economies have gained experience in hosting minerals activities, in attracting minerals investment, in regional and global cooperation, and in deriving benefits from minerals development.

In addition, minerals markets and investment patterns have changed, as have benchmarks for sustainable development, and environmental, social and governance (ESG) performance.

The major changes relevant to the aims of AMCAP are discussed in the following sections.

2.2.1 Market recovery from COVID-19 impacts

Following a period of sustained global economic growth, the impacts of the COVID-19 pandemic and responses by government and business dramatically reduced economic activity in the first half of 2020. Economic activity recovered following the easing of initial lockdown measures, but second and successive waves of the pandemic led to new restrictions in several nations and in the EU.

Nevertheless, the China economy has rebounded swiftly, as have economies of several other Asian, North American and European nations that have managed to reduce impacts of the pandemic. Global demand for minerals is expected to continue to rise, driven principally by investment in infrastructure, growth of consumption, and transformation of energy and industry towards a lower carbon future and digital future. Despite COVID-19 disruptions, manufacturing in Europe, North America and Southeast Asia has recovered to be close to pre-pandemic levels as firms and their employees have adapted to the new “COVID normal”.

After a slump due to initial impacts of the pandemic, minerals and metals prices quickly resumed their pre-COVID up-trend. By December 2020, metals prices overall were higher than pre-pandemic levels[2].

Within this trend, however, there have been movements in demand and supply, and consequently prices, for several minerals and metals. These movements and medium term and long-term demand, supply and price forecasts are discussed in Chapter 3.

ASEAN Member States will be able to benefit from this demand increase if they are able to respond to attract investment in exploration and mineral development, increase production and generate sustainable benefits.

2.2.2 Market macro-trends driving change in minerals demand

Growth in consumption, manufacturing and infrastructure is driving up demand for most minerals. Demand from China is leading, but growth is also evident in Southeast Asia, North America and Europe. Within this demand increase are several trends some of which are well-documented; some less so:

- A big increase in demand for minerals that are needed to underpin a cleaner energy future and enable energy transition for electricity supply and transport[3];
- Increasing digitalisation driving demand for mobile devices, internet-of-things devices, computers, and telecommunications technologies that are transforming the way households, businesses and industry operate and are the drivers of the so-called Fourth Industrial Revolution; and
- Minerals and their products that enable construction of infrastructure, including basic construction materials plus construction metals.

The World Bank has found that countries that host minerals that are required for energy transition, transport and digitisation are likely to see an increased demand. If development and production is well-managed, the

[2] World Bank (2020), *The outlook for metals: resilience and cautious optimism*, Data blog 8 December 2020 https://blogs.worldbank.org/opendata/outlook-metals-resilience-and-cautious-optimism

[3] International Energy Agency (2021), *The Role of Critical Minerals in Clean Energy Transitions*, May 2021. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions

World Bank said, these could contribute to economic growth and sustainable development. This therefore present opportunities for ASEAN Member States.

These trends and their implications are discussed in Chapter 3.

2.2.3 Changes in investment patterns

Changes in investment patterns have implications for ASEAN Member States. They need to understand these and respond appropriately to continue to attract investment, and to attract new investment. Some changes are driven by investors, while some are at the instigation of mining host nations themselves. Changes include:

- A rise in investment by firms from China and emerging and re-emerging investor nations;
- Host countries' desire to capture a greater share of minerals value-chains through investment by state-owned and domestic-owned companies;
- Policies that encourage resource-based industrialisation; and
- Nationalisation of mineral resources development in some important mineral producing countries.

Changes to investment patterns are discussed in Chapter 3.

2.2.4 Sustainable mineral development

Globally, many resource-rich nations and many mining companies are seeking to pursue minerals development that is more sustainable. Sustainable minerals development (SDM) includes:

- Evolving standards for environmentally and socially sustainable mineral development (plus governance), with alignment of minerals development with the Sustainable Development Goals (SDGs), rising community expectations and increased activism focused on responsible resource development, and new standards, including industry standards;
- Ensuring high standards of environmental, social and governance (ESG) performance by project operators and their contractors, greater engagement of communities, local workforces and local businesses, leading to strong flows of long-lasting benefits to communities and economies;
- Mainstreaming gender considerations into all aspects of mine planning, operation and closure in order to minimise negative impacts and maximise benefits;
- A major focus on the rights of indigenous peoples and other vulnerable groups in the context of minerals development, including increasing application of processes to achieve free, prior and informed consent (FPIC) for minerals operations on indigenous lands;
- A growing industry focus on sustainable mine closure and ensuring positive social, economic and environmental post-mining legacies;
- Increasing focus on the environmental, social and economic dimensions of artisanal and small scale mining; and
- Significant and increasing concern about mine tailings management and adoption of the Global Industry Standard on Tailings Management.

Detailed discussion of leading practices in sustainable minerals development is included in Chapter 3.

2.2.5 Institutional and human capacities

Nations that have sizeable minerals sectors that make strong economic contributions also have strong institutional capacity to govern the sector, attract investment and build human capacity to work within the sector and governance institutions.

Without strong institutional and human capacities, ASEAN Member States cannot develop mineral resources well or do well from minerals development. There is therefore an ongoing need governance capacity, through education, training and institutional capacity-building, to align capabilities of ASEAN economies, meet the challenges of evolving standards and varying performance by minerals industry operators, improve mining governance, and ensure skilled workforces for both government and industry.

Enhanced technical education and training at levels of vocational education and training (VET), university and professional development are needed for purposes both of improving minerals governance and of generating value though skilled employment and local business engagement.

There is also a need to redress imbalances of knowledge and hence negotiating power between globally operating investors and national and sub-national governments to help achieve equitable and sustainable development outcomes. This is achieved through building stronger institutional capacity and adopting leading practice policy and regulatory settings.

Capacities and engagement of non-government organisations with interests in minerals and development also need to be enhanced. Minerals industry associations, NGOs involved in transparency, sustainability and community, and universities all have important roles to play in minerals governance. It is important they build the capacity to do so.

The imperative for stronger minerals governance capacity is discussed further in Chapter 3.

2.2.6 Minerals information systems

A key attribute of nations that host strong minerals sectors is their provision of accurate, comprehensive, and timely data relevant to geology, minerals endowments and the minerals industry. Quality information allows minerals exploration and development investors to identify opportunities and make investment decisions based on effective risk assessments. Such data also enables others with interests in minerals development, including civil society, to obtain reliable information and be assured of transparency. This report identifies:

- The need for an efficient and up-to-date ASEAN minerals database, in terms of functionality, effectiveness and needs of users;
- The opportunity to utilise the minerals database, and its linkages with national minerals information systems as an effective marketing tool to investors and information tool for governments;
- Potential for showcasing ASEAN cooperation through the minerals information system to enhance investor confidence in the region; and
- Provision of information about the minerals sector in ASEAN to organisations and individuals with interests in the sector and its performance.

2.3 Cooperation and competition

While AMCAP has as one of its core goals to strengthen cooperation between member states for sustainable mineral development, there are also inevitable competitive tensions between states to attract investment in exploration, mining, and mineral processing. Key determinants of the success of AMCAP therefore will be the extent to which it:

- Operates to grow the total level of investment in the ASEAN minerals value chain; and
- Demonstrably helps to deliver investment and value to member states.

This requires attention to the design and implementation of AMCAP-III Phase 2 and ensuring that its monitoring, evaluation, reporting and learning (MERL) frameworks provide regular feedback on the value of outputs, outcomes and impacts for both the whole of ASEAN and member states.

2.4 Stakeholders in ASEAN minerals development

Such is the fundamental importance of minerals to society, the economy, and the environment, that all people, businesses, non-government organisations and governments are stakeholders in ASEAN minerals development and the way in which it occurs. There are of course, principal stakeholders from the minerals industry, non-government organisations and government that have particular as well as shared stakes in minerals development.

For this review, the University of Queensland identified and has engaged with the following stakeholders:

- AMS, as represented by ASEAN Minerals Focal Points
- Relevant government agencies within AMS
- Mining associations in AMS
- Minerals companies, both operating in AMS and not currently present
- Senior academics from minerals institutes at various universities
- Civil society organisations another non-government organisations focused on minerals-related issues within and outside AMS
- Multi-lateral & bilateral organisations and international industry bodies
- Bodies administering regional and international minerals cooperation initiatives

2.5 State of ASEAN minerals development

This section examines the performance of ASEAN Member States in terms of minerals trade, investment, exploration and production. It should be read in conjunction with Chapter 3 *Global markets and industry developments*. Much of the data cited in Chapter 2 and Chapter 3 are drawn from the metals and mining database of S&P Global Market Intelligence[4] utilised under a subscription by UQ. Most of these detailed data are not publicly available.

2.5.1 Production of minerals

Several ASEAN Member States are major producers of minerals, although only a few do this at world scale. The data in this section highlight the wide range of minerals produced. Production data also highlights the importance of development minerals produced mostly for domestic consumption in infrastructure and buildings, and to supply local business and industry.

It should be noted that up-to-date data on minerals production from each AMS can be difficult to obtain. This highlights an identified deficiency in providing timely information to internal and external parties about the minerals sector in ASEAN. In the absence of consistent data from all AMS directly, data from the United States Geological Survey[5] has been used, although it is inconsistent in terms of latest available. In some cases, more recent information has been obtained from AMS and other sources.

The key legislation governing minerals is also identified for each AMS.

[4] S&P Global Market Intelligence (2021), S&P Global Market Intelligence Capital IQ Pro platform https://www.spglobal.com/marketintelligence/en/solutions/sp-capital-iq-pro

[5] USGS (2020), 2017–2018 Minerals Yearbook, Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases. United States Geological Survey. https://www.usgs.gov/centers/nmic/asia-and-pacific

Mineral production by ASEAN as a whole

Table 1 summarises estimates of mine production across the ten ASEAN Member States in 2019. It does not take into account minerals processing beyond primary processing, which is part of the mine production process. Secondary processing is classed as manufacturing.

Table 1 ASEAN mine production, selected minerals, estimates for 2019

Commodity	Production	Units
Bauxite	1,726,734	tonnes
Cobalt	4857	tonnes
Copper	760,737	tonnes
Gold	3,432,811	ounces
Iron Ore	7,044,982	tonnes
Lead	48,500	tonnes
Manganese	6,009	tonnes
Molybdenum	1,429	tonnes
Nickel	1,178,786	tonnes
Silver	9,822,138	ounces
Tin	97,453	tonnes
Tungsten	181	tonnes
Zinc	66,000	tonnes

Source: S&P Global Market Intelligence (2021)

Brunei Darussalam minerals

The mineral sector in Brunei Darussalam is governed under the Mining Act 1984. The legislative framework for petroleum is provided by the Petroleum Mining Act 1963. The principal extractive resources produced in Brunei are gas and oil, which make up around 90 per cent of goods exports. Relevant to this report, only minor quantities of other minerals are produced, of which only cement is recorded. Cement production in 2018 was 290,000 tonnes[6].

Data on production of extractives, such as sand and gravel are not readily available. Brunei Darussalam, however, has capacity and potential for minerals processing utilising its abundant energy resources, plus large-scale fertiliser (ammonia/urea) production using natural gas as a feedstock. Figures on domestic use and export contribution of 'development minerals' like sand, gravel, limestone and aggregate are not available, but these commodities have significant potential local development impact. Assessment of this sub-sector is needed.

Cambodia minerals

Mineral production and exploration in Cambodia are governed under the Law on Mineral Resource Management and Exploitation of 2001, and the Sub-Decree on Management of Mineral Exploration and Industrial Mining Licenses of 2016.

In 2017 and 2018, mineral production was primarily cement, gravel, salt, sand, and stone. While these appear to contribute only a minor part of the economy of Cambodia, they are an essential part of the economy, being used in infrastructure and buildings. Exploration activity in Cambodia, which reached a peak in 2019, could result in a broadening of products produced and more valuable production. However, the risks of exploration and mine development need to be overcome in what is essentially a greenfield setting in a frontier region.

[6] USGS (2020), 2017–2018 Minerals Yearbook, Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases. United States Geological Survey. https://www.usgs.gov/centers/nmic/asia-and-pacific

Table 2 Mineral production, Cambodia 2016-2020 ('000 tonnes)

Commodity	2016	2017	2018	2019	2020
INDUSTRIAL MINERALS					
Cement	2,967	3,265	5,966	7,896	8,502
Silica sand		538	715	356	
Coal		56	34	14	10
CONSTRUCTION MINERALS					
Dimensioned Stone	91	2,027	188	364	1,049
Sand		7,506	16,258	19,457	24,741
Gravel		33	76	77	73
Soil	22,047	23,640	12,620	23,314	12,335
Crushed Stone	6,005	5,111	3,803	7,605	5,882

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases. United States Geological Survey. https://www.usgs.gov/centers/nmic/asia-and-pacific

Indonesia minerals

In 2020, Indonesia amended its Mining Law of 2009 to create Mining Law of 2020. The primary objectives are to expand the mining sector, reinvigorate exploration and deliver greater value to the economy. Mining Regulations to implement the revised law are in the process of being promulgated.

Indonesia is a world-ranked mining nation. In 2016, Indonesia was the third largest producer of mined tin (18 per cent of global production) and produced 9.5 per cent of the world's mine production of nickel, 3.6 per cent of copper production, and 2.6per cent of gold production. Indonesia is also a leading coal producer (total production in 2016 of 204 million tonnes) and is the world's largest exporter of steaming coal. In response to market demand, government policy and limits on exports of unprocessed mineral products, production of processed metals has increased rapidly.

Indonesia's mineral reserves are ranked fifth for gold, seventh for copper, sixth for nickel, second for tin, sixth for bauxite, and 10th for coal[7]. The minerals sector accounted for 7.2 per cent of Indonesia's GDP in 2016, with total employment in mining and quarrying of 1,476,000 persons.

Table 3 Mineral production, Indonesia 2012-2016

Commodity		2012	2013	2014	2015	2016
METALS						
Aluminum:						
Bauxite, wet basis	thousand metric tons	31,443	57,024	2,555	472	1,400
Alumina		--	--	--	70,000	600,000
Aluminum metal, primary		248,000	255,300	210,500	168,000	250,000
Chromite, mine production, sand, dry basis		10,000	19,000	7,000	5,600	5,600
Cobalt, mine production, Co content		1,700	1,700	1,300	1,300	1,300
Copper:						
Mine production, concentrate, Cu content		398,200	509,000	376,000	577,300	715,600
Leaching, electrowon		--	--	1,400	1,200	11,800
Refinery production, primary		207,000	215,000	231,800	198,400	252,000
Smelter production, primary		207,000	215,000	232,000	197,100	252,000
Gold, mine production, Au content	kilograms	69,291	59,804	69,349	99,339	85,000
Iron and steel:						
Pig iron, including direct-reduced iron	thousand metric tons	520	760	120	120	120
Raw steel	do.	2,254	2,644	4,428	4,854	4,900

[7] USGS (2021), Mineral commodity summaries 2021. United States Geological Survey. https://doi.org/10.3133/mcs2021

Commodity		2012	2013	2014	2015	2016
Iron sand, dry basis:						
Gross weight	do.	11,546	22,353	5,951	3,839	3,900
Fe content	thousand metric tons	7,220	14,000	3,720	2,400	2,400
Lead, refinery production, secondary		45,000	45,000	45,000	45,000	46,000
Manganese:[e]						
Mine production:						
Gross weight		138,000	120,000	120,000	120,000	120,000
Mn content		39,500	38,000	38,000	38,000	38,000
Ferromanganese		13,000	12,000	12,000	12,000	12,000
Silicomanganese		9,000	8,000	8,000	8,000	8,000
Nickel:						
Mine production, Ni content, laterite ore		648,000	834,000	177,000	130,000	130,000
Intermediate production, Ni content, matte		69,000	78,800	78,700	81,177	77,581
Ferronickel:						
Gross weight		91,500	91,000	82,600	85,700	89,900
Ni content		18,372	18,249	16,851	17,211	20,293
Silver, mine production, Ag content	kilograms	247,827	123,000	119,189	151,934	167,000
Tin:						
Mine production, Sn content		49,300	45,800	70,000	52,195	52,000
Smelter production, primary		51,400	48,800	58,233	65,000	45,000
Titanium mineral concentrates, ilmenite and leucoxene		103,413	26,633	1,485	23,000	20,000
Zirconium mineral concentrates		109,000	49,400	21,000	30,900	110,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	52,350	56,690	56,760	59,850	62,000
Clay and shale, bentonite		7,000	6,000	6,000	6,000	6,000
Iodine		44	43	56	45	15
Nitrogen, N content, ammonia	thousand metric tons	5,100	5,000	5,000	5,000	5,000
Salt		2,071,601	1,087,715	2,192,168	600,000	600,000
Stone, sand, and gravel:						
Silica, mine production, unspecified		38,000	35,000	35,000	35,000	35,000
Stone, crushed, granite	thousand metric tons	3,500	4,000	4,000	4,000	4,000

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

Table 4 provides estimates of Indonesian production of key minerals in 2019.

Table 4 Production estimates of selected minerals, Indonesia 2019

Commodity	2019
Bauxite (tonnes)	1,726,734
Cobalt (tonnes)	911
Copper:	
Mine production, Cu content (tonnes)	374,289
Gold (ounces)	2,080,835
Iron ore (tonnes)	1,000,000
Nickel (tonnes)	855,445
Sliver (ounces)	8,787,106
Tin (tonnes)	83,502
Zinc (tonnes)	21,000

Source: S&P Global Market Intelligence (2021)

Lao PDR minerals

The mineral sector in Lao PDR is governed under the Law on Minerals of 2008, as amended in 2012 and 2017.

Lao PDR is a geologically prospective region and a producer of a diverse range of minerals, including copper, gold, limestone, potash and silver, which make a small but significant contribution to GDP.

Table 5 Mineral production, Lao PDR 2014-2018

Commodity		2014	2015	2016	2017	2018
METALS						
Antimony, mine, Sb content		620	1,166	242	320	340
Bismuth, refinery		670	1,300	2,013	2,743	3,009
Copper:						
Mine:						
Concentrates, Cu content		71,155	78,449	89,187	90,363	83,680
Solvent extraction		88,541	89,253	78,492	62,941	68,200
Refinery, electrowon		88,541	89,253	78,492	62,941	68,200
Gold, mine, Au content	kilograms	5,265	6,893	6,764	5,988	5,579
Iron ore, mine:						
Gross weight		1,148,571	234,745	115,065	250,000	99,196
Fe content		712,114	145,542	71,340	155,000	61,502
Lead, mine, Pb content		--	--	210	660	330
Silicon, metal		9,503	5,673	6,836	1,042	8,900
Silver, mine, Ag content	kilograms	39,806	51,763	50,904	42,841	37,465
Tin, mine, Sn content		869	512	1,117	1,083	1,551
INDUSTRIAL MINERALS						
Barite		45,000	90,000	80,000	75,000	230,000
Cement, hydraulic	thousand metric tons	2,201	3,099	3,407	3,938	4,800
Clay, common		738,512	123,093	778,030	309,000	60,800
Gypsum, mine		707,908	989,516	469,436	463,039	618,783
Potash, K_2O content		210,983	250,000	195,000	300,000	335,000
Salt, rock salt		8,706	1,733	118	6,697	1,000
Stone, crushed:						
Limestone		1,148,571	1,184,093	1,348,096	2,622,992	1,066,611
Sandstone		1,132,567	314,462	1,357,199	1,660,000	1,660,000

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

Malaysia minerals

Malaysia produces bauxite, clays, coal, gold, iron ore, limestone, natural gas, petroleum, silica sand, and tin. Ilmenite, monazite, struverite (a niobium-tantalum mineral) and silver are by-products of tin and gold mining. Malaysia was also a producer of barite until 2013. Until 2014, Malaysia was a producer of bauxite, though output was relatively small. A three-year moratorium on bauxite mining was put in place in early 2016, due to environmental concerns, though production continued and was recorded at almost 5 million tonnes in 2017. The moratorium expired in March 2019. Other mineral resources, which included barite, copper, nickel, and silica rock, currently are not mined.

Malaysia also hosts a strategically significant processing plant for rare earth elements, utilising concentrates from a mine in Western Australia.

Table 6 Mineral production, Malaysia 2012-2016

Commodity		2012	2013	2014	2015	2016
METALS						
Aluminum:						
Bauxite		121,873	208,770	3,665,000	35,000,000	1,000,000
Aluminum metal, primary		120,000	290,772	400,000	400,000	620,000
Gold, mine production, Au content	kilograms	4,625	3,823	4,308	4,732	2,149
Iron and steel:						
Direct-reduced iron	thousand metric tons	2,010	140	1,330	960	660
Raw steel	do.	5,612	4,693	4,316	3,784	2,764
Iron ore, mine production:						
Gross weight	do.	12,144	12,134	9,615	1,625	1,847
Fe content	do.	6,072	6,067	4,808	813	924
Magnesium metal, primary		--	150	--	--	--
Manganese, mine production:						
Gross weight		1,099,585	1,125,127	835,429	480,727	681,667
Mn content[e]		429,000	439,000	326,000	187,000	266,000
Niobium, mine production, struverite concentrate		262	190	255	86	77
Rare earths:						
Mineral concentrate, monazite and xenotime:						
Gross weight		179	358	455	565	1,880
Rare-earth-oxide equivalent		100	180	240	310	869
Rare-earth compounds, rare-earth-oxide equivalent		--	1,138	7,190	10,900	13,172
Silicon, ferrosilicon		--	--	8,641	46,832	126,261
Silver, mine production, Ag content	kilograms	1,628	361	533	945	1,075
Tin:						
Mine production, Sn content		3,725	3,697	3,777	4,125	4,071
Smelter production, primary		37,823	32,633	35,018	30,260	26,849
Titanium, mineral concentrates:						
Ilmenite and leucoxene		22,275	16,043	8,159	5,814	4,316
Rutile		20,008	5,983	3,069	198	3,810
Zirconium mineral concentrates, zircon		442	379	677	826	653
INDUSTRIAL MINERALS						
Barite		--	500		--	--
Cement, hydraulic	thousand metric tons	22,060	22,860	24,280	24,710	22,330
Clay and shale:						
Kaolin		424,622	263,339	207,694	255,448	284,023
Unspecified	thousand metric tons	30,690	29,831	30,867	8,150	9,371
Feldspar, mine production		482,906	314,399	378,446	442,980	326,648
Lime[e]		1,100,000	1,100,000	1,400,000	1,500,000	1,600,000
Mica		3,967	4,242	5,689	4,788	4,716
Nitrogen, ammonia, N content		940,000	990,000	980,000	990,000	990,000
Stone, sand, and gravel:						
Sand and gravel, construction, unspecified	thousand metric tons	28,592	35,577	29,862	40,578	46,665
Silica, mine production, unspecified		931,880	1,243,660	1,922,874	9,002,867	10,353,297
Stone, crushed, unspecified	thousand metric tons	110,339	150,000	140,000	160,000	182,556
Stone, dimension, limestone	do.	36,580	18,000	24,000	28,000	27,187

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

Myanmar minerals

Myanmar is a fast-emerging minerals producer, with rapidly growing investment in exploration in this under-explored mineral country. While mineral production in Myanmar is still quite small, it is growing rapidly and is already a substantial economic contributor to Myanmar, with much greater potential if exploration is increased. Commodities produced include antimony, cement, coal, copper, fluorspar, jade, lead, manganese, natural gas, nickel, petroleum, petroleum products, precious and semiprecious stones, tin, tungsten and zinc. Myanmar is also one of the world's major producers of rare earths, and the second largest producer of tin.

The legislative framework for the mineral sector in Myanmar is provided by the Myanmar Mines Law of 1994 and 2015 Amendments.

Table 7 Mineral production, Myanmar 2014-2018

Commodity		2014	2015	2016	2017	2018
METALS						
Antimony, mine, Sb content		3,600	3,000	2,780	3,060	2,641
Copper:						
Mine, solvent extraction		33,200	46,900	75,000	115,100	153,000
Refinery, electrowon		33,200	46,900	75,000	115,100	153,000
Ferroalloys, ferronickel:						
Gross weight		59,000	60,000	64,462	62,366	58,000
Ni content		15,300	15,600	16,800	16,200	15,000
Gold, mine, Au content	kilograms	1,312	1,692	1,446	1,620	1,600
Lead:						
Mine, Pb content		18,000	13,600	14,000	20,900	35,000
Refinery, primary		200	600	5,900	12,000	12,000
Manganese, mine:						
Gross weight		241,800	70,200	293,000	346,000	518,000
Mn content		96,700	28,100	117,000	138,000	207,000
Nickel, mine, laterite ore, Ni content		21,000	23,000	20,000	20,000	21,000
Rare earths, mineral concentrate, rare-earth-oxide equivalent[e]		200	300	3,300	15,000	19,000
Tin, mine, Sn content		30,000	41,000	57,000	67,500	54,600
Tungsten, mine, W content:						
Tin-tungsten concentrate		244	139	181	212	212
Tungsten concentrate		3	5	2	3	3
Zinc, mine, Zn content		6,100	4,800	6,500	13,100	12,000
INDUSTRIAL MINERALS						
Barite		25,931	4,535	2,627	3,206	2,935
Cement, hydraulic		1,317,163	989,047	2,520,477	5,480,094	6,000,000
Clay, bentonite		NA	700	600	600	600
Fluorspar:						
Acid grade		--	--	--	--	20,000
Metallurgical grade		12,000	13,000	7,000	3,000	50,000
Gemstones:						
Jade	kilograms	12,746,000	29,880,000	36,755,000	37,986,000	28,136,000
Pearl	do.	1,579	1,556	1,619	1,766	1,630
Other precious and semiprecious stones	do.	2,002	3,659	2,411	1,486	1,279
Gypsum, mine		70,196	94,395	245,789	361,015	309,343
Nitrogen, ammonia, N content		79,000	67,000	37,000	48,000	53,000
Salt, rock salt		162,089	133,815	212,041	158,499	189,146
Stone, construction:						
Crushed, limestone	thousand metric tons	7,900	5,900	15,100	32,800	35,900

Commodity	2014	2015	2016	2017	2018
Dimension, dolomite	1,800	2,200	2,200	2,200	2,200

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

Philippines minerals

The principal legislative instruments governing mining is the Philippine Mining Act of 1995 and the People's Small-Scale Mining Act 1991, which applies to artisanal and small-scale mining.

The Philippines is the one of the few world-scale minerals producers in ASEAN. The Philippines produces a large proportion of the world's nickel (up to a quarter) and has 6 per cent of the world's total reserves of nickel. It is also a major copper producer, with high prospectivity for further discovery of both copper and gold. The Philippines also produces cobalt, a key critical mineral. As at 2015, the mining and quarrying sector contributed about 1 per cent to GDP and generates about 240,000 jobs directly.

Table 8 Mineral production, Philippines 2014-2018

Commodity		2014	2015	2016	2017	2018
METALS						
Chromium, mine, chromite		47,056	15,502	25,745	20,849	45,011
Cobalt, mine, Co content		4,600	4,300	4,000	4,600	4,600
Copper:						
Mine, concentrates, Cu content		91,824	83,835	83,649	68,156	69,933
Smelter, primary		153,200	189,200	215,000	240,000	170,900
Refinery, primary		130,000	153,000	185,100	205,000	170,800
Gold, mine, Au content	kilograms	18,423	21,314	23,053	22,749	20,765
Iron ore, mine:						
Gross weight		153,775	107,119	17,088	--	--
Fe content		98,000	68,000	11,000	--	--
Iron and steel:						
Raw steel		1,196,000	968,000	1,075,000	1,378,000	1,500,000
Products, hot rolled		3,273,000	4,013,000	4,346,000	4,300,000	4,300,000
Lead, refinery, secondary		30,000	28,000	14,000	10,000	10,000
Manganese, mine, concentrate:						
Gross weight		6,900	--	--	--	--
Mn content		3,000	--	--	--	--
Nickel, Ni content:						
Mine, laterite ore		393,262	415,021	300,506	339,377	344,915
Intermediate, nickel-cobalt sulfide		50,647	51,733	48,371	50,553	48,633
Silver, mine, Ag content	kilograms	23,005	29,952	35,186	31,737	29,782
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	21,305	24,050	25,000	26,000	26,000
Clay:						
Bentonite		3,369	3,477	3,231	2,618	2,412
Kaolin		7,050	8,179	10,059	10,000	10,000
Unspecified		8,605	8,948	11,542	11,500	11,500
Feldspar		34,232	38,067	46,630	47,000	47,000
Lime		7,877	22,538	173,968	135,618	136,000
Perlite		17,194	18,575	21,645	11,545	9,696
Phosphate rock:						
Gross weight		3,897	5,437	8,019	8,600	8,600
P_2O_5 content		1,325	1,850	2,700	2,900	2,900
Pumice and related materials:						

Commodity		2014	2015	2016	2017	2018
Pumice		6,018	6,261	8,306	8,179	8,200
Volcanic tuff		28,884	40,775	47,966	48,000	48,000
Salt, sea salt		134,000	131,000	128,000	125,000	122,000
Sand and gravel, industrial, silica	thousand metric tons	467	438	502	507	1,220
Stone, sand and gravel, construction:						
Sand and gravel	do.	161,453	170,280	194,646	195,000	195,000
Stone:						
Crushed:						
Dolomite		2,948,034	3,073,695	1,839,178	1,584,507	1,560,737
Limestone	thousand metric tons	77,665	75,657	75,255	77,909	78,000
Volcanic cinder		6,856	7,736	8,658	9,200	9,200
Other	thousand metric tons	12,417	11,330	12,088	14,303	12,911
Dimension, marble		60,572	67,494	93,304	229,130	224,786
Zeolites		--	8,468	6,177	4,127	3,600

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

Estimates of production of selected minerals by the Philippines in 2019 are set out in Table 9.

Table 9 Production estimates of selected minerals, Philippines 2019

Commodity	2019
Cobalt (tonnes)	4,600
Copper:	
Mine production, Cu content (tonnes)	71,892
Gold (ounces)	840,372
Molybdenum (tonnes)	329
Nickel (tonnes)	303,341
Sliver (ounces)	503,466

Source: S&P Global Market Intelligence (2021)

Singapore

Singapore is not a mineral producer itself but imports a large amount of mineral raw materials to feed manufacturing. The country is a gold refining and trading hub for the sector and hosts, along with Indonesia, the major gold refineries in ASEAN. As identified in the following section, minerals trade is important to Singapore, with minerals products making up 14 per cent of total imports and 25 per cent of exports, with metals adding another 3 per cent of exports[8]. Minerals-intensive electronics make up a large component of exports and sales are forecast to continue to increase.

Table 10 Mineral production, Singapore 2014-2018

Commodity[2]	2014	2015	2016	2017	2018
METALS					
Iron and steel, raw steel	540,000	501,000	520,000	596,000	600,000

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

[8] OECD (2019), Economic Outlook for Southeast Asia, China and India 2020: Rethinking Education for the Digital Era, OECD Publishing, Paris, https://doi.org/10.1787/1ba6cde0-en

Thailand minerals

Minerals activities in Thailand are governed by the Minerals Act, BE 2560 (2017). The mining industry is overseen by the Department of Primary Industries and Mines within the Ministry of Industry (MOI) at central level, and by the local mineral industry officials (LMIOs) at the provincial level. In common with most other AMS, other government agencies also have regulatory powers over various elements of mining projects.

Thailand has opportunities to increase its mineral production. It is already one of the world's leading producers of feldspar and gypsum. Thailand also produces, iron ore, manganese, silver, tin, tungsten, zinc and lead, plus a variety of industrial minerals. Until 2015, Thailand was also a copper producer, and until 2017, also produced gold and silver. Thailand is prospective for the fertiliser mineral, potash, with a major new mine proposed. The mining and quarrying sector is a small but increasing employer.

Table 11 Mineral production, Thailand 2014-2018

Commodity		2014	2015	2016	2017	2018
METALS						
Antimony:						
Mine, ore, Sb content		--	--	32	--	--
Refinery		706	700	700	700	700
Copper, refinery		229	--	--	--	--
Gold, mine, Au content	kilograms	4,514	3,305	4,293	--	--
Iron ore, mine:						
Gross weight		347,918	16,483	--	135	--
Fe content		216,000	10,200	--	84	--
Iron and steel, raw steel	thousand metric tons	4,095	3,720	3,824	4,471	4,315
Lead, refinery, secondary, lead alloys		79,250	86,000	86,000	88,000	85,000
Manganese, mine:						
Gross weight		14,330	9,000	9,150	8,020	4,000
Mn content[e]		6,900	4,300	4,400	3,900	1,900
Rare earths, mine, concentrates						
Gross weight		3,200	1,300	2,600	2,200	1,700
Rare-earth-oxide equivalent		1,900	760	1,600	1,300	520
Silver, mine, Ag content	kilograms	31,046	21,047	35,954	--	--
Tin:						
Mine, concentrates, Sn content		156	72	92	541	75
Smelter, primary		16,494	10,616	10,807	10,588	10,721
Tungsten, mine, concentrates:						
Gross weight		173	61	57	114	127
W content		99	35	33	65	69
Zinc:						
Mine, ore:						
Gross weight		226,893	181,025	175,632	7,877	--
Zn content		39,140	34,738	34,500	1,460	--
Smelter, primary		70,100	74,121	72,813	30,018	--
Alloys, Zn content		21,000	22,200	21,800	9,010	--
INDUSTRIAL MINERALS						
Barite		81,996	72,000	140,000	67,000	13,149
Calcite		991,981	1,281,765	1,452,235	1,456,747	1,467,822
Cement, hydraulic	thousand metric tons	36,150	36,216	34,860	33,587	35,750
Clay:						
Ball clay		123,082	81,245	136,646	157,093	579,565
Cement clay		4,124,016	4,792,683	4,506,878	4,301,793	5,837,807
Ceramic clay		312,963	514,044	371,686	357,982	485,853
Kaolin:						
Beneficiated		123,621	102,763	101,618	102,659	96,666

Commodity		2014	2015	2016	2017	2018
Nonbeneficiated		755,913	655,196	830,393	401,450	403,225
Diatomite[5]		194	188	833	800	649
Feldspar		1,413,428	1,331,916	1,167,147	1,385,925	1,117,803
Fluorspar:						
Metallurgical grade		4,590	15,095	20,100	5,500	16,700
Acid grade		33,000	34,000	37,000	25,000	42,000
Gypsum, mine	thousand metric tons	12,445	11,267	10,407	9,254	9,680
Lime		800,000	780,000	780,000	820,000	810,000
Perlite		54,100	17,200	15,690	5,800	5,600
Phosphate rock:						
Gross weight		500	--	--	8,000	--
P_2O_5 content		150	--	--	2,400	--
Quartz		194,831	188,650	50,160	176,083	67,802
Salt		1,381,067	1,385,911	1,390,548	1,497,233	1,487,364
Sand and gravel, industrial, unspecified		1,133,906	1,191,612	1,102,699	1,756,308	1,557,218
Stone, sand, and gravel, construction:						
Stone:						
Crushed:						
Dolomite, for ceramic		2,471,486	2,432,853	3,034,860	2,988,336	3,440,193
Granite	thousand metric tons	7,591	8,075	9,459	9,036	11,281
Limestone	do.	94,710	103,388	106,923	108,480	116,292
Marble, including fragment		1,636,503	2,629,588	2,568,888	1,995,310	3,060,329
Marl, for cement		1,200	--	--	8,200	28,707
Shale, for cement	thousand metric tons	5,409	6,277	7,590	6,506	6,716
Dimension:						
Granite		8,005	13,878	14,860	14,437	3,535
Marble		28,475	31,619	30,986	42,639	19,663
Travertine		5,103	1,350	2,600	1,969	949
Talc and related materials:						
Pyrophyllite		49,100	45,500	96,800	54,000	50,920
Talc		8,208	6,768	7,126	7,436	7,756

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

Viet Nam minerals

Mineral activities in Viet Nam are governed under the Law on Minerals and associated guiding documents. As in other AMS, a number of other laws, such as those governing water, environmental protection and investment, also regulate key aspects of mineral activities. The Ministry of Natural Resources and Environment (MONRE) oversees mineral activities nationally, while provincial authorities have local regulatory authority. Other relevant agencies include the Ministry of Industry and Trade (minerals master plans and export controls) and the Ministry of Construction (oversight of construction minerals).

Mining and quarrying currently are estimated to contribute more than 8 per cent of Viet Nam's GDP and to generate some 240,000 jobs. Viet Nam is richly endowed with minerals, including antimony, barite, bauxite, bismuth, copper, fluorspar, graphite, nickel, rare earths, silica sand, silver, tin, titanium, tungsten, zinc and zircon. It is assessed as having world class reserves of many minerals and/or as being a globally significant producer. The reserves of so many minerals and relatively small production of most indicate that Viet Nam has great potential to become a major mining and minerals processing economy.

Viet Nam hosts the world's third largest reserves of bauxite, but to date has been a relatively small producer of bauxite and its downstream product, alumina (2019 production 4 million tonnes and 1.4 million tonnes respectively). Viet Nam is a major world producer of bismuth and tungsten and has been assessed as

prospective for copper. Assessed rare earths reserves are amongst the world's largest, but production is currently small. Mineral processing is an important sub-sector, with processed mineral products including refined copper, rolled steel, refined tin and zinc.

Table 12 Mineral production, Viet Nam 2014-2016

Commodity		2012	2013	2014	2015	2016
METALS						
Aluminium:						
Bauxite		100,000	482,000	1,090,000	1,150,000	1,419,000
Alumina	thousand metric tons	--	214	485	660	602
Antimony, mine production:						
Gross weight		1,199	2,476	2,745	548	511
Sb content, 40% Sb		480	990	1,100	220	204
Bismuth		--	--	2,000	2,000	1,600
Chromite, mine production		1,900	24,990	3,400	14,000	15,000
Cobalt, mine production, Co content		--	25	223	277	134
Copper, mine production, concentrate:						
Gross weight		50,862	49,148	48,394	49,032	51,476
Cu content		12,700	12,300	12,100	12,300	12,900
Gold, mine production, Au content	kilograms	1,508	1,681	164	--	100
Iron and steel:						
Pig iron	thousand metric tons	650	650	1,393	1,700	2,000
Raw steel	do.	2,965	3,484	3,954	4,093	4,901
Products, rolled	do.	8,405	9,252	10,739	12,543	15,083
Iron ore, mine production:						
Gross weight		2,842,000	4,708,200	5,130,200	4,222,300	5,951,000
Fe content, 53% Fe		1,506,200	2,495,329	2,719,000	2,691,000	3,154,000
Lead, mine production,-Pb concentrate, Pb content		360	1,870	2,980	2,750	810
Manganese, mine production						
Gross weight		15,800	9,700	760	--	300
Mn content		6,800	4,200	330	--	100
Nickel, mine production, concentrate, Ni content		--	1,166	6,854	8,607	4,300
Rare earths, monazite concentrate:						
Gross weight		370	180	--	460	400
Rare-earth-oxide equivalent		1,700	2,000	2,600	2,700	2,900
Tin:						
Mine production, Sn content		3,191	5,129	4,833	4,530	4,579
Smelter production, primary		3,095	4,961	4,688	4,382	4,919
Titanium mineral concentrates, ilmenite and leucoxene		978,300	1,025,800	558,000	238,000	102,000
Tungsten:						
Mine production, concentrate, W content		1,050	1,660	4,500	5,600	6,500
Ferrotungsten		--	511	764	400	500
Zinc:						
Mine production, Zn content		30,000	20,000	17,000	15,000	12,000
Smelter production, primary		18,000	12,000	12,000	10,000	10,000
Zirconium mineral concentrates		22,500	10,200	10,000	4,300	9,500
INDUSTRIAL MINERALS						
Apatite		2,364	2,656	2,471	2,923	2,849
Barite		90,000	55,000	95,000	80,000	35,000
Cement, hydraulic	thousand metric tons	56,353	57,516	60,982	67,645	77,278
Fluorspar		600	300	50,000	191,000	155,000
Lime	thousand metric tons	850	850	850	840	840

Commodity		2012	2013	2014	2015	2016
Nitrogen, ammonia, N content		830,000	1,000,000	1,100,000	1,100,000	1,100,000
Phosphate rock:						
Gross weight	thousand metric tons	2,365	2,656	2,471	2,758	840
P_2O_5 content	do.	665	745	700	800	240
Salt	do.	776	718	906	1,061	933
Stone, sand, and gravel:						
Sand and gravel, construction, unspecified, including silica sand	do.	83,223	87,205	91,231	93,072	95,531
Stone, crushed, all grades	do.	226,814	222,540	244,349	262,177	274,264

Source: USGS (2020), 2017–2018 Minerals Yearbook Volume III: Area Reports—International—Asia and the Pacific, and subsequent data releases.

2.5.2 Trade in minerals

This section examines the importance of minerals and metals in two-way trade in each ASEAN Member State. Minerals production is a key component of the economies of most AMS, though its importance varies, depending on factors such as the scale of production, and the size and diversity of other parts of each economy. Imports of minerals and metals are also very important to all AMS, to supply manufacturing and other sectors such as agriculture and construction.

Contributions to national Gross Domestic Product (GDP) are difficult to estimate, but for most AMS, primary mineral products and processed materials generate significantly to GDP as well as providing feedstock for manufacturing and materials for construction. Minerals and coal production and processing have potential to increase and contribute more to ASEAN economies.

Note that data below derives from the OECD[9] using the Trade Map database[10] and classifies “mineral products” to include actual minerals as scientifically categorised, plus coal and petroleum products.

Brunei Darussalam

Mineral products from Brunei Darussalam make up 91 per cent of exports, which are dominated by petroleum rather than metallic minerals, reflecting the nature of the resource base of the nation. Minerals products and metals, however, make up 35 per cent of Brunei’s imports, reflecting its need for raw materials for processing, manufacturing and construction.

Data from World Integrated Trade Solution (WITS) database[11] shows that in 2018, the value of mineral exports, excluding petroleum, from Brunei was negligible, (US$90,000) while imports were valued at US$60.6 million.

Cambodia

Cambodia exports only a small amount of minerals (2 per cent of total exports as metals), reflecting its so far small minerals sector. Mineral products to feed its industries, including agriculture, make up a significant proportion (11 per cent) of imports.

The WITS database shows that in 2016 (latest data available), the value of mineral exports from Cambodia was only US$738,000, while import value totalled US$99.5 million.

[9] OECD (2019), Economic Outlook for Southeast Asia, China and India 2020: Rethinking Education for the Digital Era, OECD Publishing, Paris, https://doi.org/10.1787/1ba6cde0-en
[10] ITC (2021), Trade Map, International Trade Centre, Geneva, www.trademap.org
[11] World Integrated Trade Solution 2021, World Bank and UNCTAD, https://wits.worldbank.org/

Indonesia

Indonesia, as a mining nation of global significance, generates nearly 40 per cent of exports from minerals and processed metals. At the same time, Indonesia is a major importer of minerals and metals (34 per cent of total imports) to feed its manufacturing sector and supply agriculture.

The WITS database reinforces the importance of minerals trade. It shows that in 2018, minerals generated $US5.6 billion in export value and US$1.5 billion in import value.

Lao PDR

The minerals sector is a major component of the economy of Lao PDR. Minerals and metals comprise 52 per cent of exports, while making up 27 per cent of imports.

Malaysia

The minerals and metals sector is an important contributor to trade for Malaysia, generating a 25 per cent of exports and 28 per cent of imports. Malaysia's mineral processing and manufacturing sectors generate most of this trade activity. In 2018, export value was $US1.7 billion and imports were valued at US$2.9 billion.

Myanmar

Myanmar has some of the fastest growing trade in minerals and metals, which in 2018 generated 30 per cent of total exports (mineral export value $US30.1 million) and 37 per cent of imports ($US112.6 million).

Philippines

While mining is an important sector in the Philippines, minerals and metals generate a small but still significant proportion of trade: 9 per cent of exports and 24 per cent of imports. In 2018, minerals exports were valued at $US1.3 billion and imports at US$1.7 billion.

Singapore

While Singapore does not undertake primary production of minerals, the sector is still a large contributor to trade, contributing 14 per cent of export and 28 per cent of imports[12]. In 2018, minerals exports were valued at US$178.6 million and imports at US$1.16 billion[13]. This reflects Singapore's role in minerals processing and manufacturing using minerals products.

Thailand

The contribution of minerals to Thailand's exports has declined, with mining of copper, gold and silver ceasing during the previous few years. Nevertheless, minerals trade value in 2018 was substantial, with exports at US$1.1 billion and imports at US$746 million. For imports by Thailand, minerals and metals make up a major component: 33 per cent.

Viet Nam

Despite substantial mineral production in Viet Nam, that data on trade curiously shows a small contribution to both exports and imports. This may be because a large part of production is used domestically. The WITS database reports that minerals export value in 2017 was US$1.1 billion and import value at US$844 million.

2.5.3 Decline in spending on minerals exploration

A serious threat to future minerals investment and production in ASEAN Member States is the decline in investment in exploration. This is in both nominal terms and in 'market share' relative to global exploration

[12] OECD (2019), Economic Outlook for Southeast Asia, China and India 2020: Rethinking Education for the Digital Era, OECD Publishing, Paris, https://doi.org/10.1787/1ba6cde0-en

[13] World Integrated Trade Solution 2021, World Bank and UNCTAD, https://wits.worldbank.org/

investment. For many ASEAN Member States, this decline has been occurring for 10 years, indicating a pronounced trend.

Within this decline is a fall in early-stage or grassroots exploration and a concentration of reduced total spending in mine site exploration. This reduces the likelihood of new discoveries required to grow or even sustain current levels of mineral production.

Further, major global explorers are under-represented in the ASEAN region, seemingly preferring to invest elsewhere. Discussions with mineral associations and a survey of mining companies conducted for this project provide some indications as to why this is occurring.

The ASEAN region has historically underperformed in attracting exploration investment, relative to the rest of the world. Analysis of global exploration data for 2020 reveals expenditure of about US$200 million or a ‘market share’ for Southeast Asia of global exploration at just 2.4 per cent of total global exploration spend of US$8.3 billion.

As shown in Figure 1, the exploration budget in Southeast Asia/Pacific has fallen steadily in both nominal and relative terms since the high of 2012 of US$1,347m or 6.5 per cent of global budget to a low in 2020 of US$271m or 3.2 per cent of global budget. This is the lowest annual budget since 2005.

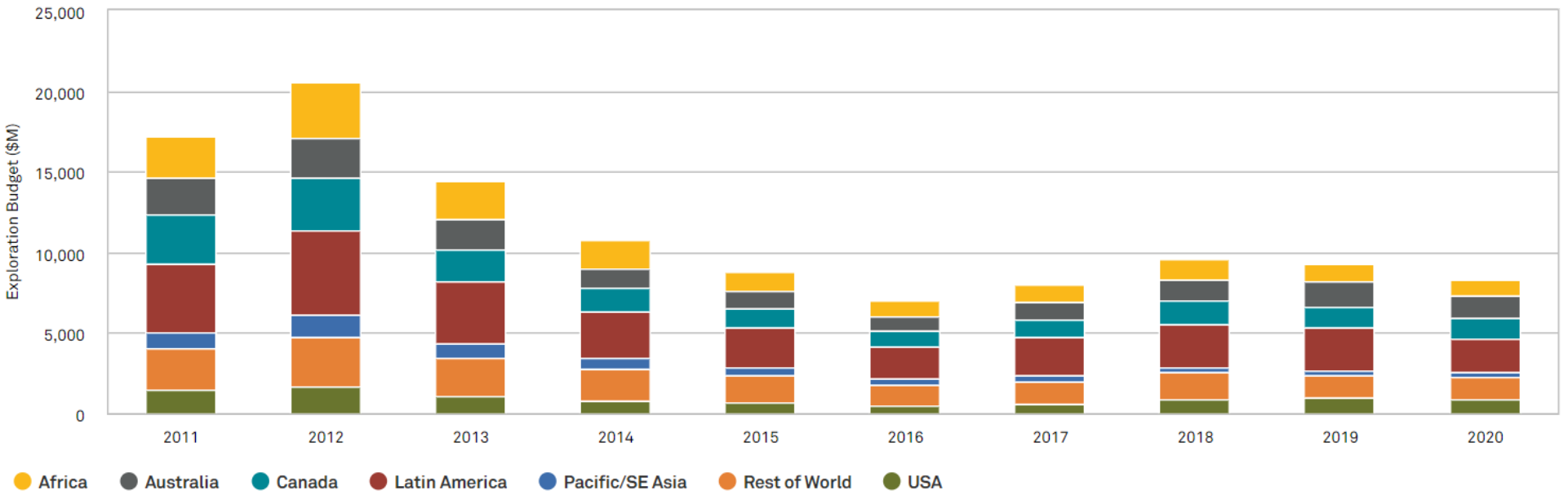


Figure 1 Exploration budgets by global region, 2011-2020

Source: S&P Global Market Intelligence (2021)

The pattern of the Southeast Asia / Pacific[14] exploration budget by development status differs markedly from global budget, as shown in Figure 2. The trend is worsening, as Table 13 shows.

First, there is a marked decline in the Southeast Asia/Pacific budget, while the global budget trend has been positive. That means the region is losing market share. Second, the region is trending even more than global budgets towards less grassroots exploration, raising questions about long term sustainability of current minerals activity.

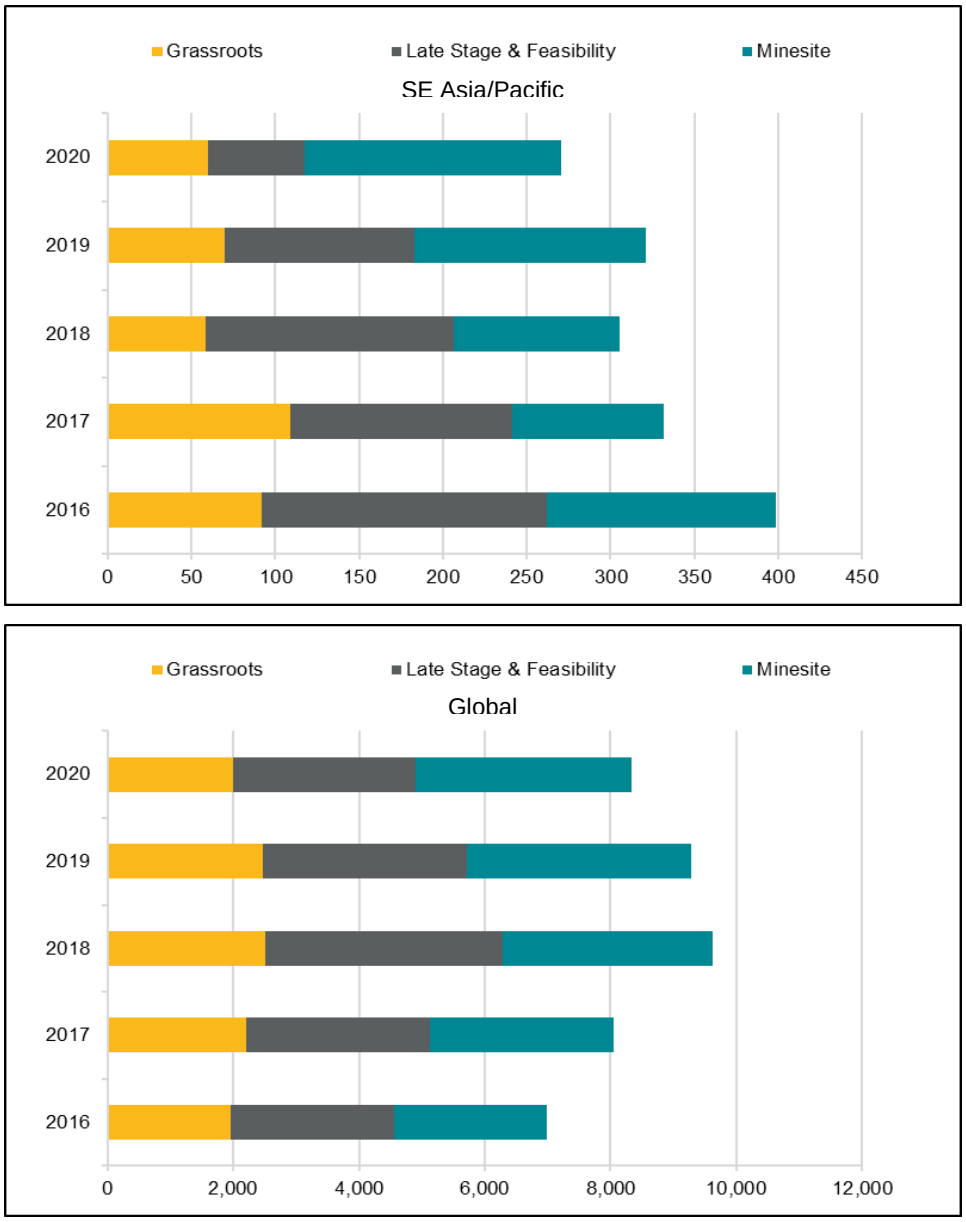


Figure 2 Southeast Asia/Pacific and Global exploration budgets by development status.
Source: S&P Global Market Intelligence (2021)

[14] Database limitations mean that South East Asia and Pacific regions are combined in this version. Country analysis revels very similar patterns of exploration investment. South East Asia exploration budget makes up 73% of the total South East Asia/Pacific budget.

Table 13 Southeast Asia/Pacific exploration budget by stage of development (US$m)

Development Stage	2016	2017	2018	2019	2020
Grassroots	92.2	108.8	58.8	70.1	59.9
Late Stage & Feasibility	169.9	132.4	147.7	113.2	57.9
Minesite	136.3	90.7	98.7	137.7	153.0
TOTAL	**398.4**	**331.9**	**305.2**	**321.0**	**270.8**

Source: S&P Global Market Intelligence (2021)

The loss of market share by the Southeast Asia/Pacific region is further illustrated in Figure 3, which shows the breakdown of global exploration budgets by region.

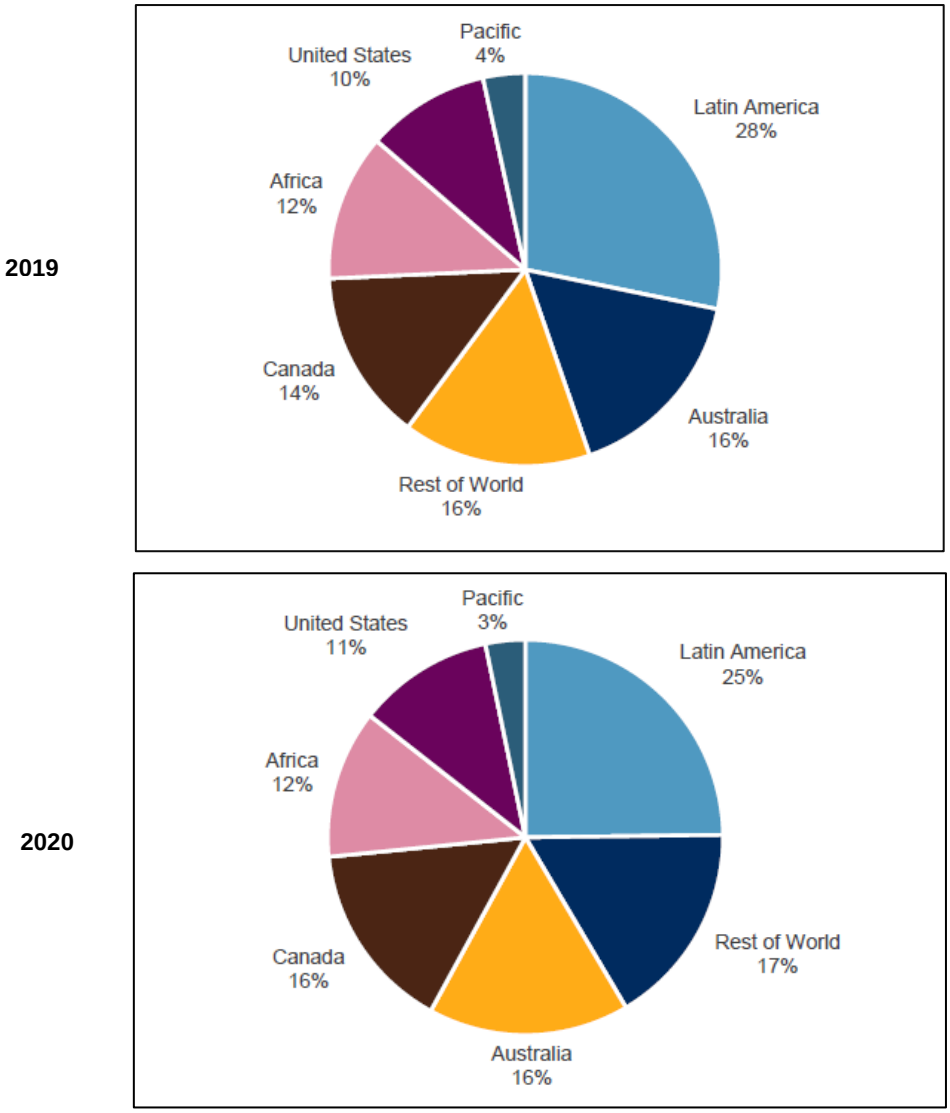


Figure 3 Exploration budget by geography, 2019 and 2020.
Source: S&P Global Market Intelligence (2021)

The Annual Survey of Mining Companies by the Fraser Institute[15] is also instructive about the prominence of ASEAN nations in the eyes of exploration and mining companies, and their advisers. Only one ASEAN country, Indonesia, now features in the rankings.

2.5.4 Mineral targets for exploration

Gold and base metals dominate the focus of exploration globally, as shown in Figure 4. Of the base metals, copper is a particular exploration target. Gold exploration is driven by the gold price and expectations of continued price strength. Base metals exploration is driven by expectations of demand and consequent prices.

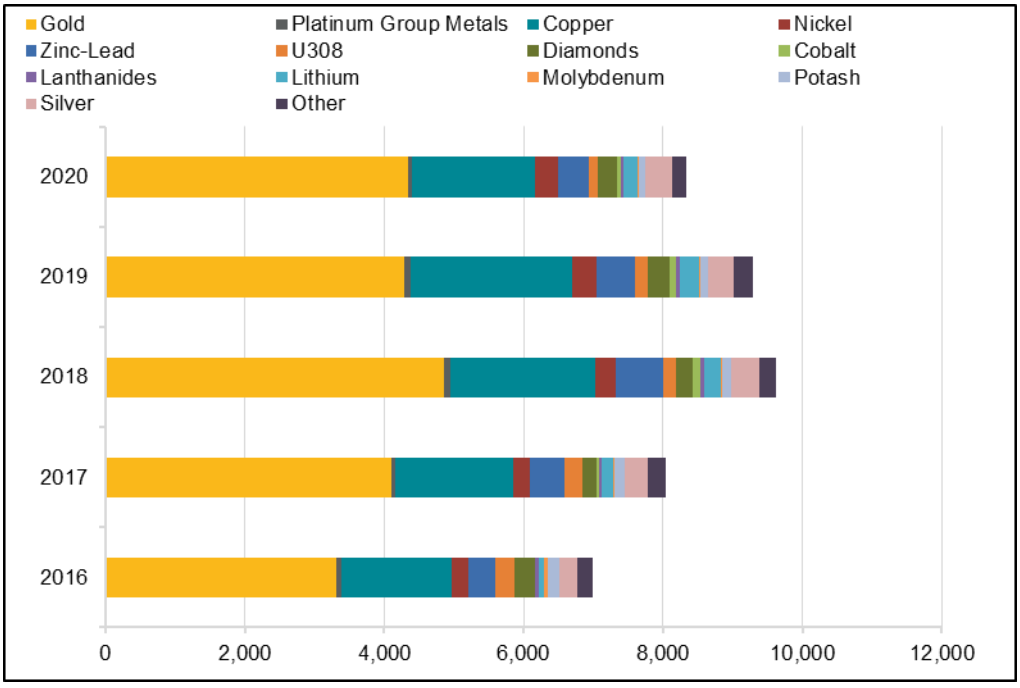


Figure 4 World exploration budget by commodity, 2016-2020
Source: S&P Global Market Intelligence (2021)

Table 14 World exploration budgets by commodity, 2016-2020 (US$ million)

Commodity	2016	2017	2018	2019	2020
Gold	3,318.5	4,094.9	4,852.5	4,293.1	4,344.1
Platinum Group Metals	74.3	56.1	104.5	77.5	56.8
Copper	1,576.6	1,703.8	2,073.1	2,318.5	1,757.5
Nickel	238.2	244.3	297.8	351.6	333.9
Zinc-Lead	378.4	488.6	671.8	563.7	447.9
U308	283.7	255.7	191.2	180.3	122.4

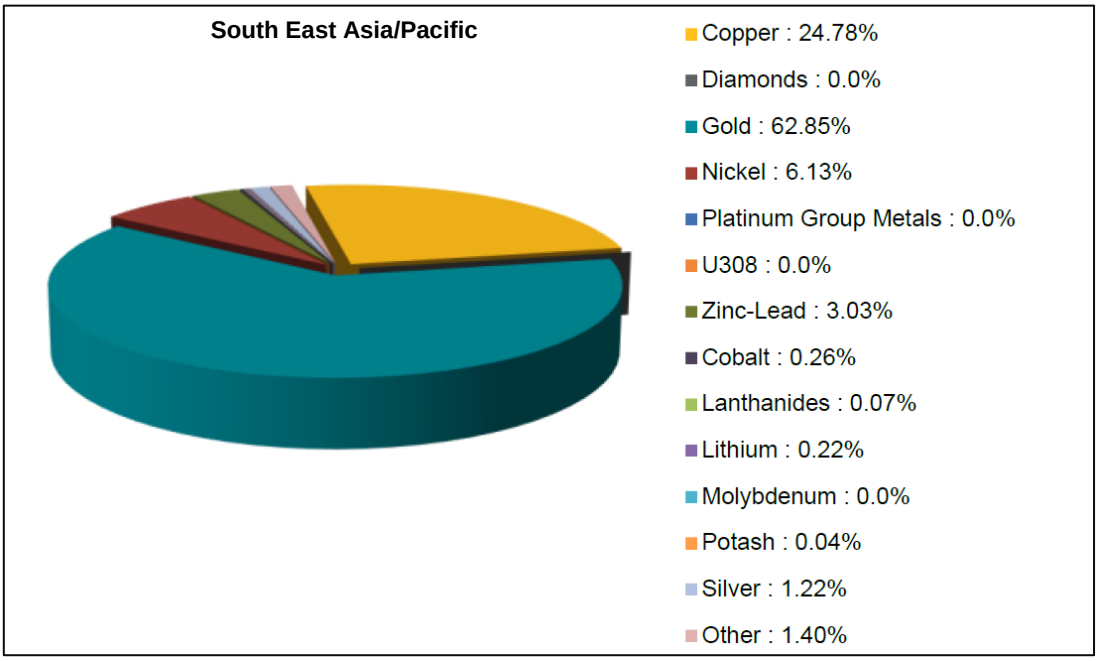
[15] Fraser Institute (2021), Fraser Institute Annual Survey of Mining Companies 2020, Fraser Institute, Vancouver, Canada https://www.fraserinstitute.org/studies/annual-survey-of-mining-companies-2020

Commodity	2016	2017	2018	2019	2020
Diamonds	289.9	207.6	228.8	306.1	273.5
Cobalt	8.4	36.2	110.8	99.6	55.6
Lanthanides (REE)	46.5	39.7	58.5	49.7	48.0
Lithium	72.9	156.5	247.1	278.7	199.1
Molybdenum	52.5	19.0	20.0	11.3	12.0
Potash	177.9	142.1	119.3	113.9	86.5
Silver	256.1	344.7	411.8	370.1	396.9
Other	216.4	256.2	237.5	271.1	193.4
TOTAL	**6,990.3**	**8,045.4**	**9,624.7**	**9,285.2**	**8,327.6**

Source: S&P Global Market Intelligence (2021)

A similar focus is apparent in Southeast Asia/Pacific, though with gold and copper exploration budgets together comprising 88 per cent of the total budget for 2020 (Figure 5), compared with 73 per cent of global exploration budget. Exploration for gold, copper, nickel, zinc-lead and silver totals 98 per cent of the Southeast Asia/Pacific exploration budget. This reflects three things: expectations of relative prospectivity; market projections; and for gold and nickel, the trend towards exploration at existing mine sites (Figure 6). For copper, however, it is notable that there is proportionally more exploration at grassroots and late stages together.

Table 15 shows commodity exploration budgets in the region over five years from 2016 to 2020. Notable is the increase in gold exploration budgets and the steep declines in copper and nickel budgets.



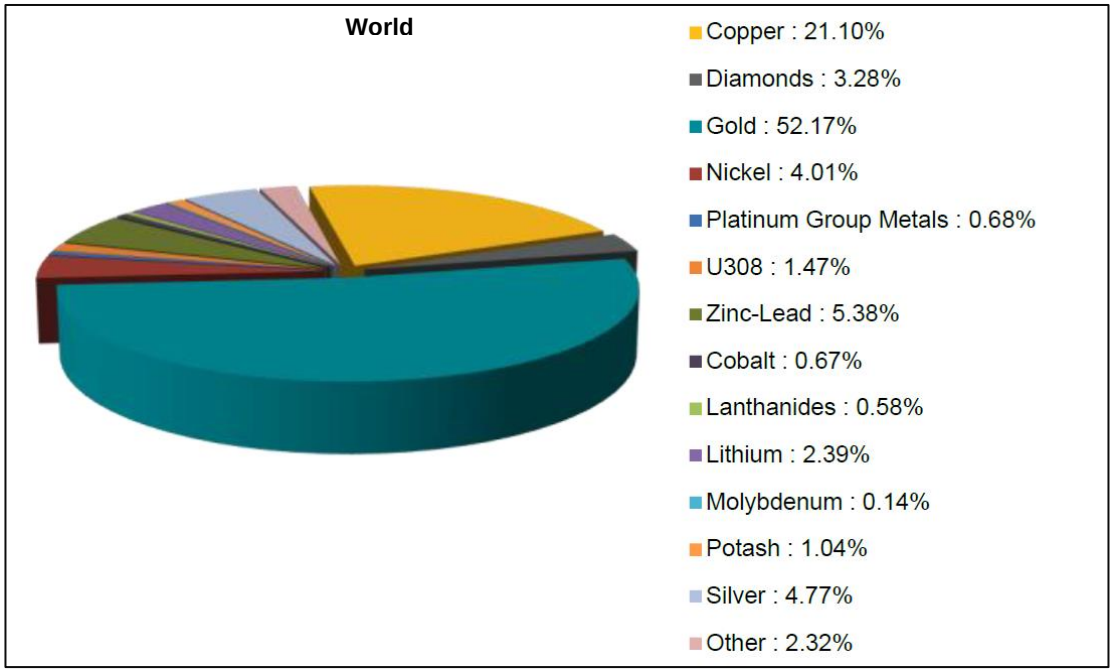


Figure 5 Southeast Asia/Pacific and World exploration budgets 2020
Source: S&P Global Market Intelligence (2021)

Table 15 Southeast Asia/Pacific exploration budgets by commodity, 2016-2020 (US$ million)

Commodity	2016	2017	2018	2019	2020
Gold	163.9	149.8	156.6	164.2	170.2
Platinum Group Metals	-	-	-	-	-
Copper	174.7	145.1	106.4	118.9	67.1
Nickel	48.3	21.0	25.6	17.8	16.6
Zinc-Lead	4.5	5.7	9.0	10.9	8.2
U308	-	-	-	-	-
Diamonds	-	-	-	-	-
Cobalt	0.6	2.5	1.5	2.2	0.7
Lanthanides (REE)	0.8	-	0.3	0.1	0.2
Lithium	-	0.2	-	-	0.6
Molybdenum	0.4	-	-	-	-
Potash	0.3	0.7	0.8	-	0.1
Silver	1.2	1.1	1.1	1.2	3.3
Other	3.7	5.8	3.9	5.7	3.8
TOTAL	**398.4**	**331.9**	**305.2**	**321.0**	**270.8**

Source: S&P Global Market Intelligence (2021)

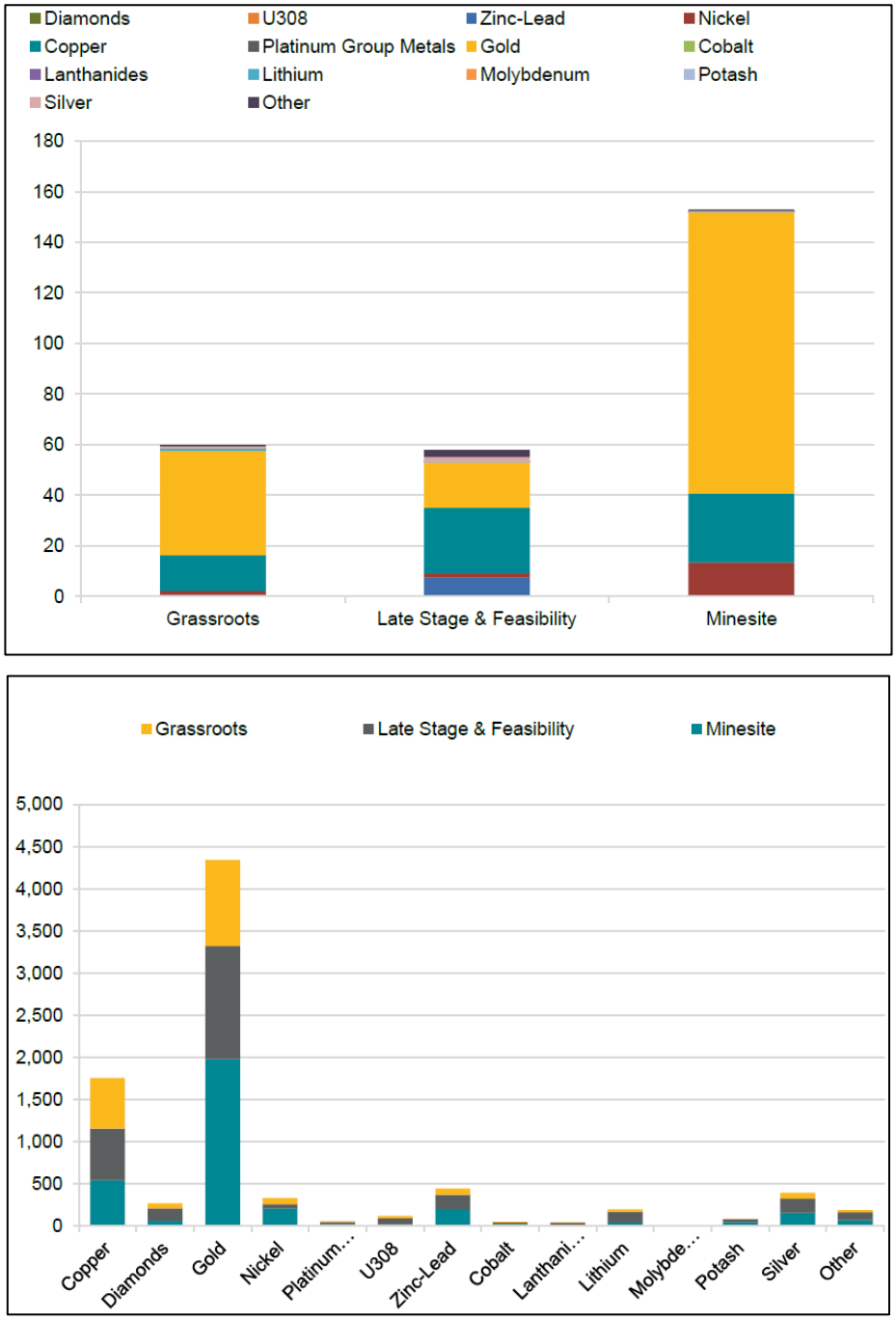


Figure 6 Southeast Asia/Pacific exploration budget by commodity and stage ($M), 2020
Source: S&P Global Market Intelligence (2021)

2.5.5 Major exploration investors and destinations

The make-up of the exploration budget in the Southeast Asia/Pacific region spread quite evenly between companies (Table 16), with the top ten explorers making up just over half of the total budget. This is different to the global exploration budget (Table 17), in which the top ten make up only 23 per cent of the total. It is noteworthy, however, that only one of the global top ten explorers (Vale) is represented in the top ten in the Southeast Asia/Pacific region. Given that major companies generate more than half of global exploration expenditure, their lack of representation in the Asia-Pacific region is more reason for concern.

Table 16 Exploration spending by top ten companies operating in SE Asia/Pacific, 2020

Company	SE Asia/Pacific Budget Total ($M)	% Share of SE Asia/Pacific Total	Global Budget Total ($M)
PT Merdeka Copper Gold, Tbk.	27.0	10.0%	27.0
PT J Resources Asia Pasifik Tbk	19.5	7.2%	19.5
PanAust Limited	17.7	6.5%	17.7
Vale S.A.	16.3	6.0%	152.6
OceanaGold Corporation	16.0	5.9%	20.0
Ok Tedi Mining Limited	16.0	5.9%	16.0
Myanmar Metals Limited	9.2	3.4%	9.2
Harmony Gold Mining Company Limited	8.8	3.2%	16.2
B2Gold Corporation	8.0	3.0%	71.0
K92 Mining Inc.	8.0	3.0%	8.0
Others	124.3	45.9%	1,971.1
TOTAL	**270.8**	**100.0%**	**2,328.3**

Source: S&P Global Market Intelligence (2021)

Table 17 Exploration spending by top ten companies operating globally, 2020

Company	World Budget Total ($M)	% Share of World Total	Global Budget Total ($M)
Rio Tinto	449.0	5.4%	449.0
Newmont Corporation	268.1	3.2%	268.1
Barrick Gold Corporation	210.0	2.5%	210.0
Vale S.A.	152.6	1.8%	152.6
AngloGold Ashanti Limited	140.0	1.7%	140.0
Kirkland Lake Gold Ltd.	140.0	1.7%	140.0
Antofagasta Plc	132.1	1.6%	132.1
Anglo American Plc	120.0	1.4%	120.0
Fresnillo Plc	120.0	1.4%	120.0
Agnico Eagle Mines Limited	115.4	1.4%	115.4
Others	6,480.4	77.8%	6,480.4
TOTAL	**8,327.6**	**100.0%**	**8,327.6**

Source: S&P Global Market Intelligence (2021)

Table 18 Spending in ASEAN by top headquarter countries, 2020

HQ Country Name	Exploration Budget ($M)	% Share of Total
Australia	97.2	35.9%
Indonesia	60.8	22.5%
Canada	40.7	15.0%
Brazil	16.3	6.0%
Papua New Guinea	16.0	5.9%
Philippines	12.3	4.5%
South Africa	8.8	3.2%
Japan	7.6	2.8%
South Korea	3.0	1.1%
China	3.0	1.1%
Others	5.1	1.9%
TOTAL	**270.8**	**100.0%**

Source: S&P Global Market Intelligence (2021)

Table 19 Exploration budgets in ASEAN destination countries, 2020 ($M)

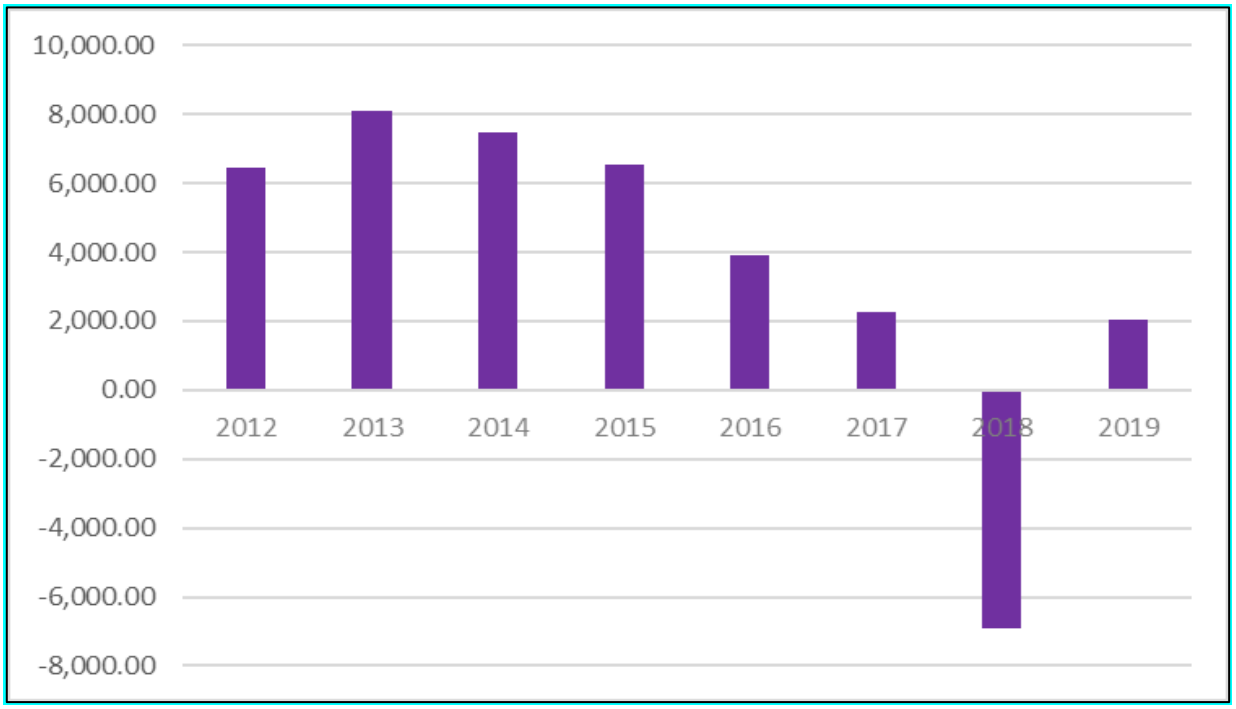
Destination Country	Exploration Budget ($M)	% Share of Total
Indonesia	94.8	48%
Philippines	29.0	15%
Myanmar	24.8	13%
Viet Nam (2019)	20.1	10%
Brunei Darussalam (2019)	18.4	9%
Lao PDR	4.4	2%
Cambodia	3.4	2%
Malaysia	2.2	1%
Thailand	0.6	1%
Singapore	-	0%
TOTAL	**197.7**	**100.0%**

Source: S&P Global Market Intelligence (2021)

2.5.6 Foreign direct investment in mining

In addition to the decline in exploration in ASEAN, there are also concerning trends in inflows of foreign direct investment (FDI) to mining within ASEAN. Figure 7 shows a marked decline trend from global sources since 2014. While intra-ASEAN FDI to mining has fallen less, the total FDI is much smaller than from global sources (which include ASEAN sources).

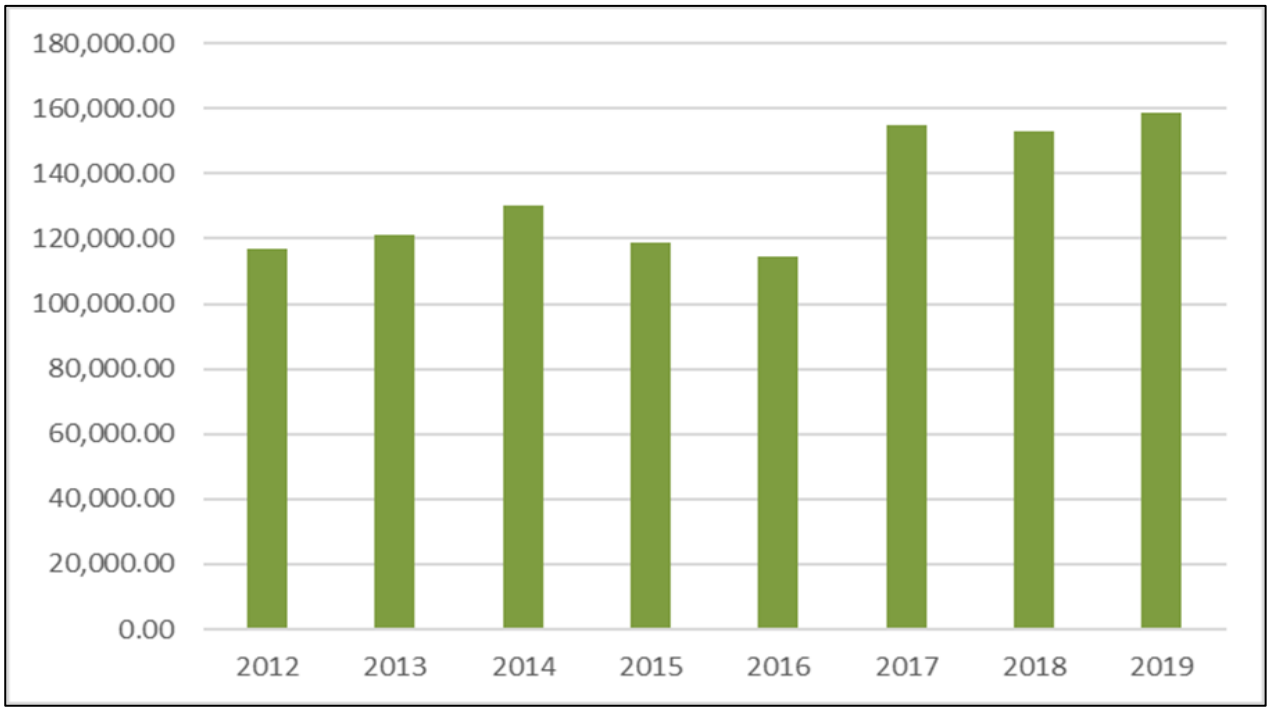
Figure 7 Flows of Inward Foreign Direct Investment to mining sector in ASEAN states from global sources (million US$)



Source: ASEANStatsDataPortal (2020), ASEAN Statistics Division. https://data.aseanstats.org/

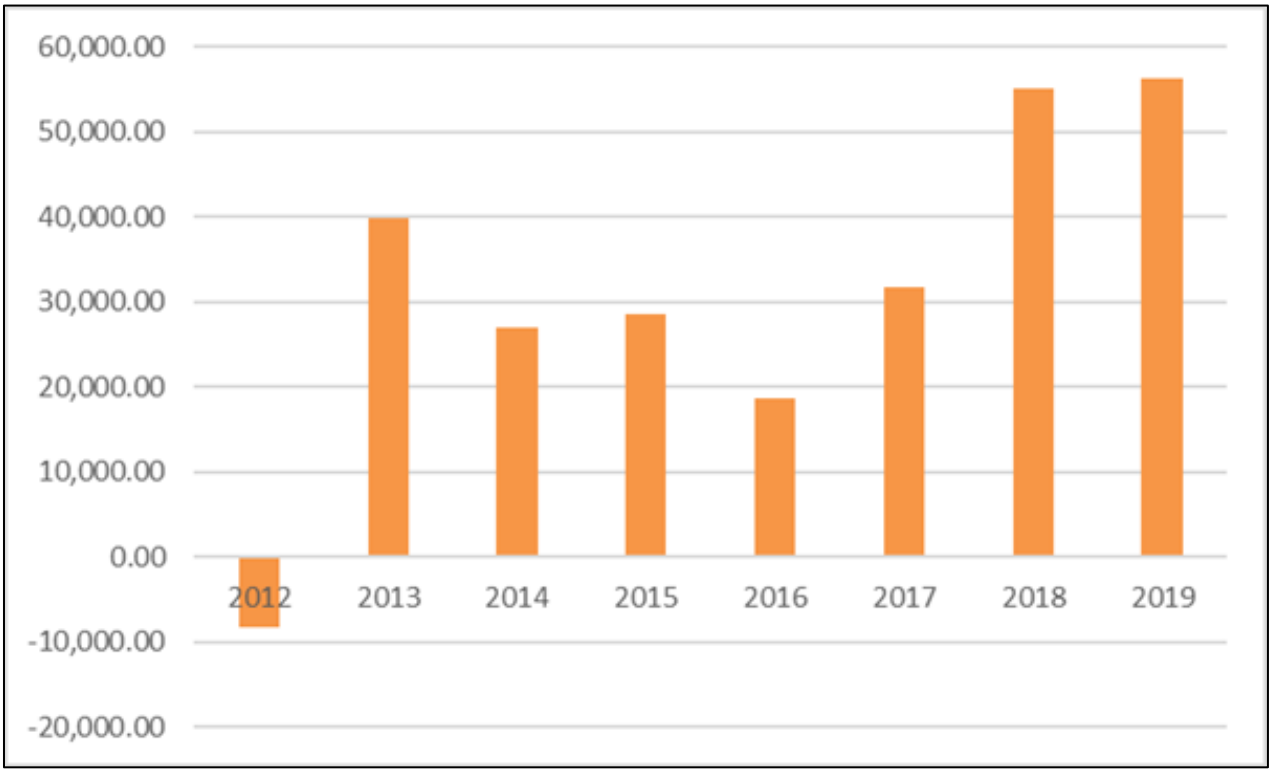
This trend compares poorly with increasing FDI across all sectors in ASEAN (Figure 8). It seems mining investors are moving away from ASEAN against the FDI trend. The trend is also at odds with FDI trends for manufacturing and construction within ASEAN – the two largest customer sectors for mining (Figure 9 and Figure 10).

Figure 8 Flows of Inward Foreign Direct Investment to all sectors in ASEAN states from global sources (million US$)



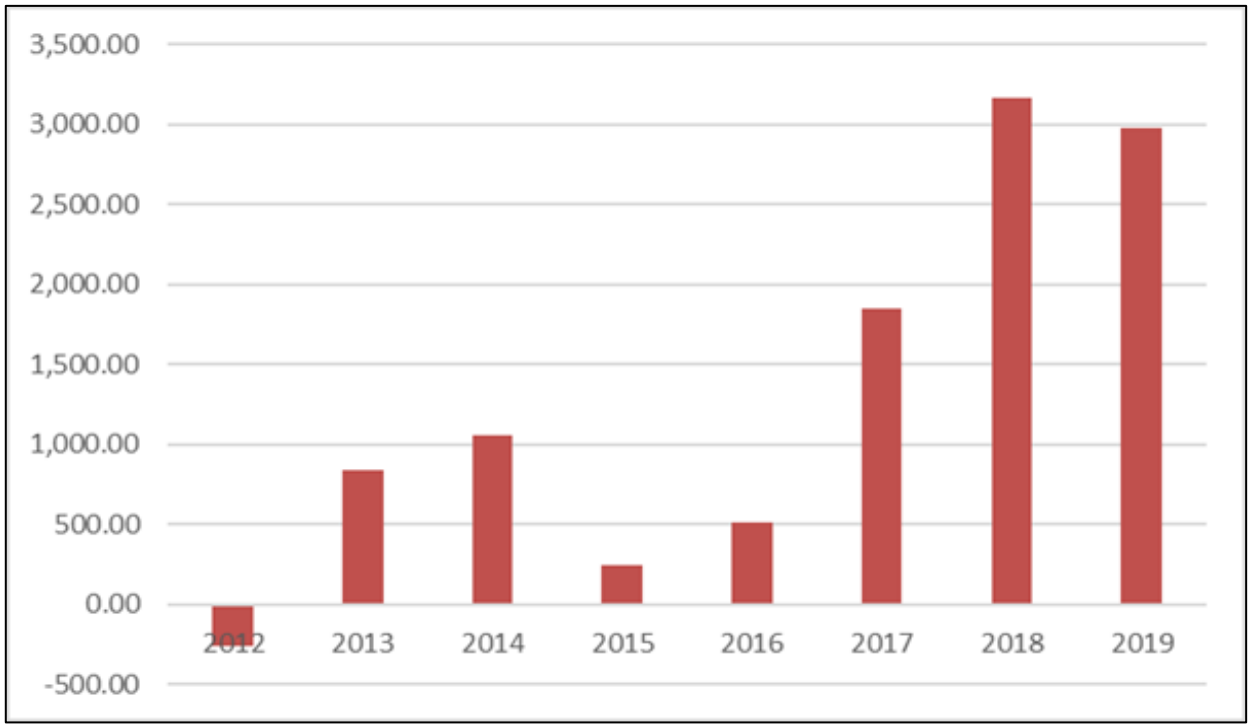
Source: ASEANStatsDataPortal (2020), ASEAN Statistics Division.

Figure 9 Flows of Inward Foreign Direct Investment to manufacturing sector in ASEAN states from global sources (million US$)



Source: ASEANStatsDataPortal (2020), ASEAN Statistics Division.

Figure 10 Flows of Inward Foreign Direct Investment to construction sector in ASEAN states from global sources (million US$)



Source: ASEANStatsDataPortal (2020), ASEAN Statistics Division.

2.5.7 Supplier responses to ASEAN production shortfalls

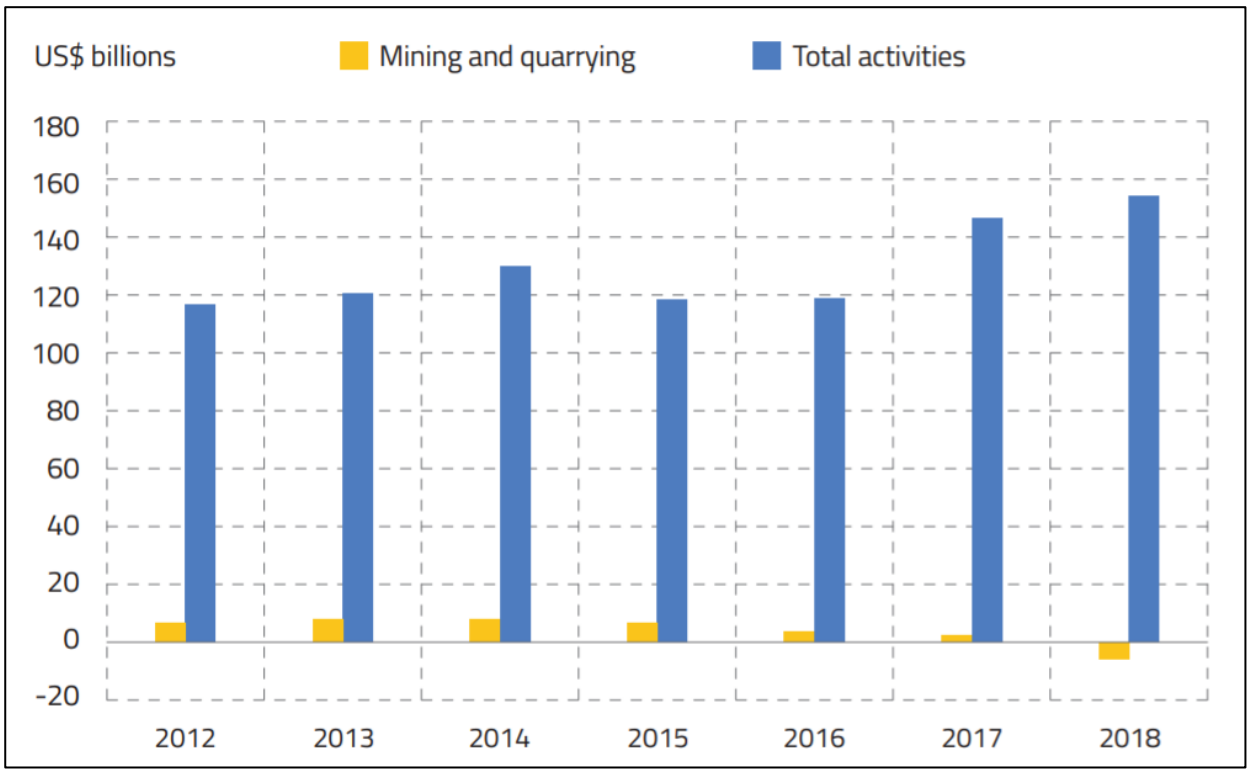
Mineral supplier nations are aware of future supply opportunities to ASEAN to feed demand in the face of potential production shortfalls relative to growing demand. In 2020, the Minerals Council of Australia industry association released a report *New frontiers: ASEAN*[16]. This report sets out the Australian view of ASEAN as a destination for mining FDI and highlights the market opportunities for exports of Australian minerals and mining equipment, technology and services (METS).

The report makes an unflattering observation about the foreign direct investment climate in ASEAN and sets out an FDI chart, which is reproduced in Figure 10:

> *ASEAN is not on the whole an attractive destination for foreign direct investment (FDI) in non-oil and gas mining and quarrying.*
>
> *The drying up of international investment is linked to the unpredictable policy environment. Uncertainty over tax obligations and poor coordination across government are examples in some ASEAN countries. It is also linked to the growing prominence of environmental activism; legacy issues associated with predatory mining practices; and resources nationalism.*

[16] MCA (2020), *New Frontiers: ASEAN*, Minerals Council of Australia, Canberra, Australia. https://www.minerals.org.au/news/new-frontiers

Figure 11 Inflow of FDI into ASEAN, total and mining and quarrying



Note: 2018 data are preliminary.

Source: MCA (2020), New Frontiers: ASEAN, Minerals Council of Australia, Canberra, Australia. https://www.minerals.org.au/news/new-frontiers

The report notes that:

> *Australia is underweight in FDI in ASEAN mining. This is probably due to the unpredictable policy environment.*

The report highlights the growth of minerals imports in text and a chart (see Figure 12):

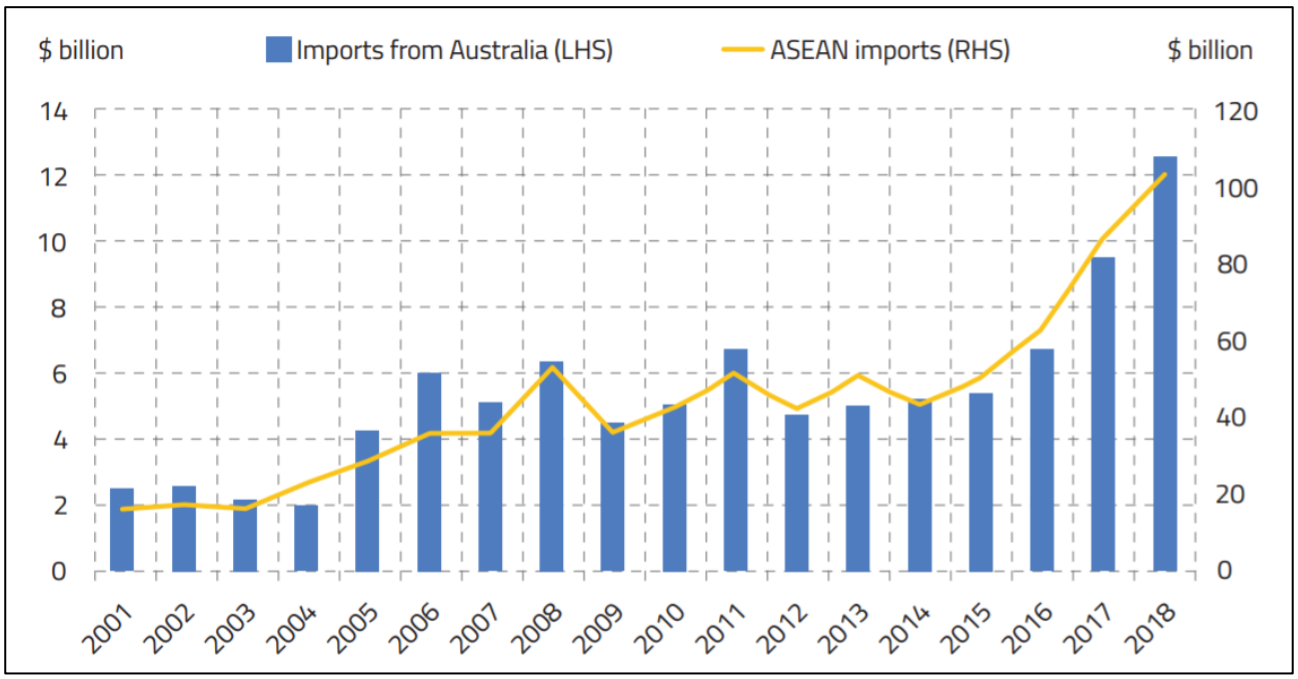
> *ASEAN imports of minerals and basic metals are growing rapidly. Over the last five years, its top 10 mining and basic metal manufactures imports have almost doubled.*
>
> *Import growth has been faster in aggregate than for China, India and Japan, and was faster than for the rest of the world minus ASEAN.*

The report concludes:

> *ASEAN is a big and highly concentrated market for Australian minerals and basic metal manufactures.*

The report also observes that Australian METS companies operate across Southeast Asia but are focused on a small group of ASEAN members, but that METS investment and exports have high further potential.

Figure 12 ASEAN imports of ten key minerals and metals



Note: The ten key commodities are: gold, unwrought or in semi-manufactured or powder form; coal, briquettes, ovoids, similar solid fuels manufactured from coal; refined copper and copper alloys, unwrought; semi-finished products of iron or non-alloy steel; unwrought aluminium; diamonds, whether or not worked, but not mounted or set; ferrous waste and scrap, remelting ingots of iron or steel; iron ore and concentrates; unwrought zinc; and ferroalloys. Laos and Myanmar are not included for 2001-2009. Data for 2017 and 2018 are estimated for some smaller ASEAN economies.

Source: Minerals Council of Australia (2020), *New Frontiers: ASEAN*

2.6 Drivers of underperformance in minerals investment in ASEAN

2.6.1 Perceptions of exploration potential

The Fraser Institute Annual Survey of Mining Companies[17] publishes an Investment Attractiveness Index for major minerals economies (national and/or sub-national) that combines both its Policy Perception Index (PPI) and results from the Best Practices Mineral Potential Index (BPMPI). In other words, the Investment Attractiveness Index takes industry perceptions of *both* geological and policy prospectivity into account.

The BPMPI ranks perceived mineral potential of jurisdictions "assuming their policies are based on 'best practices' (i.e., world class regulatory environment, highly competitive taxation, no political risk or uncertainty, and a fully stable mining regime)".

Only Indonesia now features in the Fraser Institute indices, though the Philippines was previously included. All other ASEAN Member States are currently judged not to be sufficiently important destinations for minerals investment to be included. That is an indicator of the lack of prominence of ASEAN in the priorities of many investors. Improved geological prospectivity with better geodata, together with improved policy prospectivity through clarity of policy and investor-friendly regulation and governance should result in attracting greater investment. That in turn will lift global awareness of the mineral prospects of ASEAN.

[17] Fraser Institute (2021), Fraser Institute Annual Survey of Mining Companies 2020, Fraser Institute, Vancouver, Canada https://www.fraserinstitute.org/studies/annual-survey-of-mining-companies-2020

2.6.2 Minerals policies and country risk

Risk ratings are important in investor decision-making between jurisdictions. As the Fraser Institute Annual Survey of Mining Companies 2019 makes clear:

> *While geologic and economic evaluations are always requirements for exploration, in today's globally competitive economy where mining companies may be examining properties located on different continents, a region's policy climate has taken on increased importance in attracting and winning investment.*

The Survey of Mining Companies 2020 reports that:

> *…respondents consistently indicate that approximately 40 percent of their investment decision is determined by policy factors.*

Investment risks are routinely assessed when investors consider a location for capital allocation. The performance of ASEAN Member States varies highly on perceived risk. The University of Queensland has accessed the authoritative assessments of global specialist risk consultancy Control Risks[18] [19] 20 for each AMS. Control Risks assesses risks across four categories: political, operational, security and terrorism. It ranks them as insignificant, low, medium or high.

2.6.3 Perceptions revealed from consultation

During the study, 65 stakeholder organisations were consulted in the following categories:

- ASEAN Member States (via Minerals Focal Points)
- Mining associations in ASEAN
- Exploration and mining companies
- Non-government organisations and academics
- Multilateral organisations
- Mineral cooperation initiatives.

Consultation was via questionnaires applied on-line and structured interviews. To obtain the views of NGOs and academics, an online workshop was held to encourage discussion and seek consensus.

Investor perceptions

The responses from investor representatives revealed consistent views about the drivers of investment and reasons many minerals investors prioritise other locations than ASEAN.

The results of consultation reveal the reasons behind the declining performance of ASEAN Member States in attracting investment, particularly in early-stage exploration. The trends are long-term and not readily reversed. The reasons are concerning and not easily redressed.

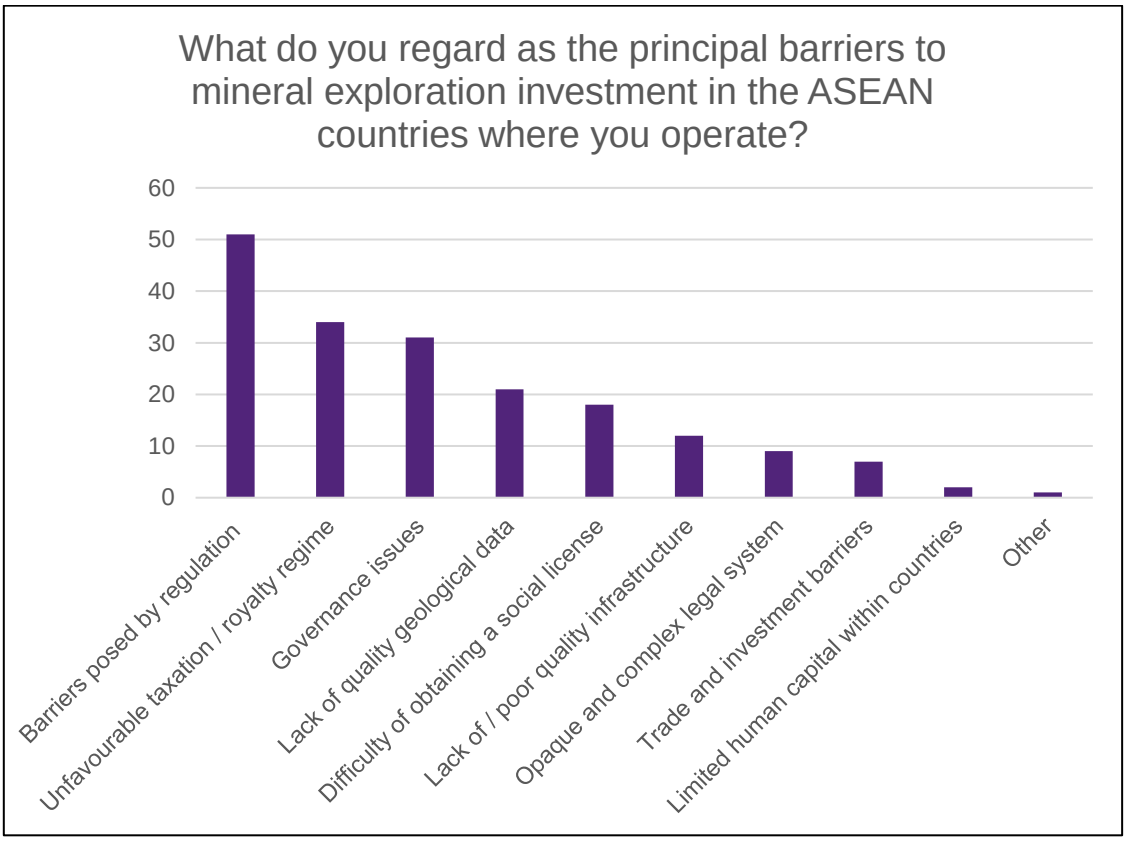
In summary, AMS individually are uncompetitive in the fundamentals of minerals investment attraction: clear, efficient and consistent regulation; sound governance; fair taxation and royalty regimes; and high quality pre-competitive geological data.

[18] Risk data accessed via S&P Global Market Intelligence platform at https://platform.spgi.spglobal.com/
[19] Control Risks is a specialist risk consultancy that advises clients on building organisations that are secure, compliant and resilient in an age of ever-changing risk and connectivity. See https://www.controlrisks.com/

If ASEAN is to grow its minerals investment, production and trade, ASEAN Member States must resolve the reality of negative investor perceptions. This will be difficult, as once lost, investment is hard to re-attract. Minerals companies have made financial commitments elsewhere, with a view to the long-term.

The settings put in place by governments – policies, regulation, taxation and royalties, and governance – together make up the most important decision criteria for investors. Availability and quality of geological data are also key. When *barriers* to exploration in ASEAN are identified (Figure 13), similar issues arise: government regulation and taxation and royalties settings, plus governance. Lack of quality geological data and difficulties in gaining a social licence to operate are also negative factors.

Figure 13 Principal barriers to mineral exploration investment in ASEAN countries



Source: UQ stakeholder consultation

For investment in mine development (Figure 14), the barriers are similar, but with difficulty in obtaining a social licence to operate the second most important factor in the eyes of investors.

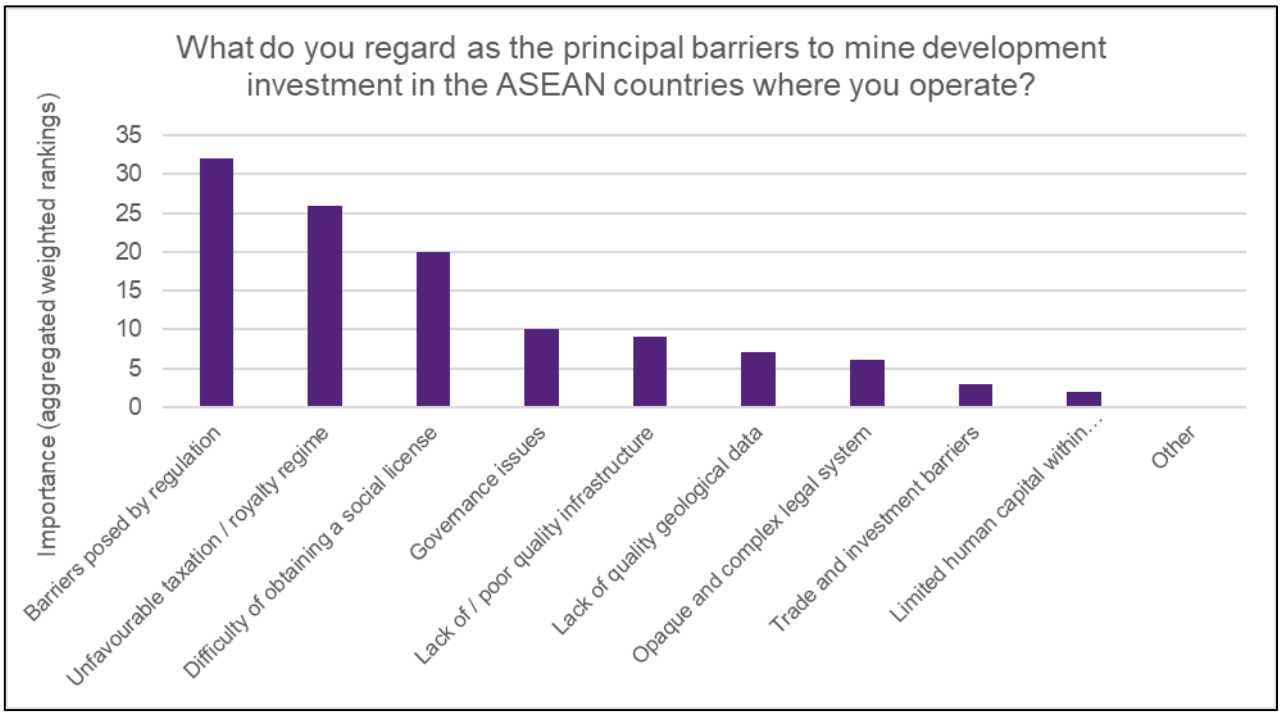
Investors proposed a range of measures that governments and industry should take to improve the investment climate and these were fairly consistent across exploration, mine development and mineral processing. They are reflected in the recommendations. Examples for government action, both as individual states and collectively, for addressing barriers to investment in exploration and mine development worth highlighting here, include:

- Implementing consistent policies and regulations among ASEAN nations, bearing in mind 'harmonisation' across all policies in infeasible;
- Streamlining policies to speed up permit approvals;
- Simplifying license systems;

- Bringing the rights of foreign investors on par with national investors in a host country;
- Providing adequate and transparent information on investment processes across AMS through a good online information system;
- Having a clear taxation and royalty regime; and
- Ensuring clear guidelines exist for stakeholder engagement and community participation in decision-making about projects.

Investors also highlighted that the minerals industry has a role to play in supporting governments to address barriers.

Figure 14 Principal barriers to mine development in ASEAN countries



Source: UQ stakeholder consultation

For minerals *processing* investment, the number two investment consideration identified was geographic proximity to markets, for which ASEAN has an advantage. Otherwise, the identified barriers were very similar to those of establishing a mine.

Actions that might be taken by governments to address these barriers are similar to those for mine exploration and development. Additional suggestions included:

- Providing good infrastructure and facilities to attract investors;
- Supporting companies in their communications and other engagement with communities;
- Enabling easier access to skilled foreign labour;
- Promoting cooperation in trade between AMS, rather than ASEAN nations competing against each other, for example in terms of nickel processing; and
- Facilitating a comparative study and sharing knowledge of best practices among ASEAN nations.

Views of non-government organisations

The views of non-government organisations (NGOs) are important to a nation's ability to attract minerals investment, particularly in relation to obtaining social licences to operate, a key consideration of investors. The NGOs and academics engaged for this study stated that civil society had largely not be included previously in AMCAP's design and implementation. Given the types of issues impeding investment, such as difficulty in obtaining social license to operate, they emphasised the importance of civil society being involved in AMCAP-III Phase 2. NGOs and academics suggested three key measures:

- A joint ASEAN policy commitment on responsible mineral development, ideally involving a set of principles endorsed by governments, industry and civil society;
- Adopt principles for good mining governance. NGOs and academics pointed out that an extractive industries governance framework has already been developed for the ASEAN region; and
- Establish a forum for dialogue between government, industry and civil society, perhaps based on the Multi-stakeholder Group (MSG) model used by the Extractive Industries Transparency Initiative[21].

Other suggestions made by NGOs and academics included:

- The need for AMS to share information on their mineral policies and regulations;
- Greater attention needs to be paid to the small-scale mining sector, which tends to lack good practices, whether in term of technology used, environmental and social standards, or lack of formalisation; and
- Strategies to ensure AMS' national interests are addressed in mineral cooperation.

[21] EITI. Multi-stakeholder governance, Extractive Industries Transparency Initiative, Oslo, Norway, https://eiti.org/oversight

Chapter 3: Global markets and industry developments

Key findings

- Global minerals markets have recovered rapidly from what has turned out to be a transitory shock from the COVID-19 pandemic, and for several minerals, prices are now higher than pre-pandemic.
- Global economic growth and consequent demand for minerals are expected to be strong in both the short term, as nations emerge from the economic shocks of COVID-19, and long term as growth in manufacturing and infrastructure resumes, notably in China and elsewhere in Asia, as well as in North America and Europe.
- Changes in minerals demand as well as increases in demand are resulting from low carbon policies and practices by governments and industries, the "Fourth Industrial Revolution" of digitalisation and moves to create circular economies. Big increases in infrastructure construction will also drive demand.
- Sustainability, ESG principles and low carbon practices are being embraced by governments, minerals companies and customers. Suppliers that can assure supply chains have an increasing market advantage, while jurisdictions that adopt high sustainability standards become preferred investment destinations for global companies.

3.1 Macro and emerging trends

3.1.1 Rapid market recovery from COVID-19 impacts

Global demand for minerals continues to rise in the medium and long term, driven principally by global economic growth, structural change within developing economies, increased consumption, more manufacturing output, and increased investment in infrastructure. Despite COVID-19 disruptions, manufacturing in China, Europe, North America and Southeast Asia has already recovered to close to pre-pandemic levels.

Prices were also pushed up for some metals due to production disruptions in Latin America due to COVID-19 restrictions. While the COVID-19 pandemic initially gave rise to market uncertainty and some short-term volatility, minerals and metals prices quickly recovered to resume an up-trend. As noted earlier, metals prices are generally higher than pre-pandemic levels[22].

Within this trend, however, there are some movements in demand and supply, and consequently prices, for several minerals and metals. For example:

- Iron ore prices in 2020 and early 2021 hit highs not experienced for more than a decade due to demand for steel-making in China and restricted supply from Brazil, and while prices have moderated since, demand remains strong;
- A recovery in automobile sales and other lifts in aluminium demand has resulted in higher prices for alumina and aluminium;
- Fast rising production of electric vehicles has driven up demand for battery minerals;
- Increased mine production capacity in lithium initially depressed prices in 2020, though demand is absorbing new supply and prices have risen strongly in 2021;
- LME copper prices have surged to a multi-year high, driven by demand optimism and some supply disruptions;

[22] World Bank (2020a), *The outlook for metals: resilience and cautious optimism*, Data blog 8 December 2020. https://blogs.worldbank.org/opendata/outlook-metals-resilience-and-cautious-optimism

- The United States and Europe have sought to diversify and secure supply chains for critical and strategic minerals; and
- Gold demand and prices have soared as investors have sought safe haven, but prices are expected to ease in the face of improving economic conditions and reduced volatility.

Metals demand during COVID-19 has proved to be more resilient than during the Global Financial Crisis, reinforcing expectations of ongoing recovery. Assuming a relatively rapid regional and global recovery from the social and economic shocks of COVID-19, underpinned by rollout of effective vaccines over the next 12 to 24 months, demand is expected to continue to rise, with a general upward trend in prices. Markets can be expected to return to relative stability, albeit with some underlying macro trends influencing demand, supply and prices, as discussed in the next section.

Medium term and long-term demand, supply and price forecasts are discussed below. In summary, minerals demand is expected to grow in the medium and long term. The OECD[23] projects that use of primary materials (mostly minerals and energy products) will almost double from 89 gigatonnes (Gt) in 2017 to 167 Gt in 2060. It is notable that the OECD projects that development minerals (e.g. sand, gravel and limestone for cement production) make up the largest share (about half) of total materials use. Metals use is expected to grow more rapidly, however.

The OECD notes that despite increased demand and output, 'materials density' is expected to reduce as use of minerals and other materials becomes more efficient.

3.1.2 Economic growth and consumption

After a period of strong and sustained growth, the COVID-19 pandemic led to a collapse of economic activity in the first half of 2020. Economic output recovered swiftly following the easing of strong lockdown measures, with consumer-facing businesses restarting trade and supply chains being restored. Successive waves of the pandemic have led to new lockdowns in several nations and in the EU, however, hitting economies and further disrupting production and trade.

The OECD reports that global economic consequences have been severe. The recovery is faster than expected, however, with the OECD revising its projections four times since September 2020.

Figure 15 shows the projection from May 2021, which had the current size of the global economy at about 5 per cent smaller than projected pre-pandemic. Estimates of the number of years since quarter four of 2019 to return to pre-pandemic real GDP per capita levels are shown by country in Figure 16.

Global recovery is projected to be uneven, but China's GDP is projected to be down only 1.3 per cent on its November 2019 projection, followed by manufacturing powerhouses, Germany, South Korea and the United States. This augurs well for mineral demand. The OECD[24] expects that:

> *The strongest growth in materials use is projected to occur in emerging and developing economies. China remains the largest consumer, but the central baseline scenario projects a rapid stabilisation of steel and construction materials use in China. Other non-OECD countries – such as India, Indonesia, and most countries in Sub-Saharan Africa and Asia – are projected to undergo an economic and materials use growth spurt. Even in the OECD, where economic growth rates are more modest, materials use grows between 1% and 2% per year on average*.

[23] OECD (2019), Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences, OECD Publishing, Paris. https://doi.org/10.1787/9789264307452-en
[24] OECD (2019), Global Material Resources Outlook to 2060

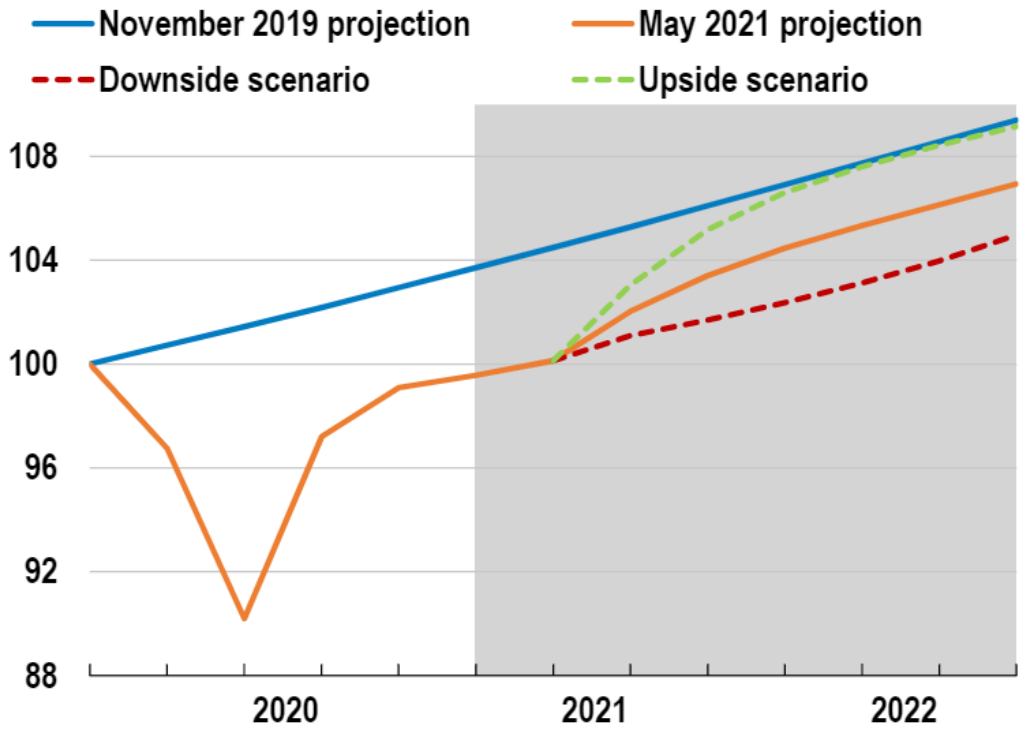


Figure 15 World GDP projection scenarios (Index 2019 Q4 = 100).

Source: OECD (2021), Economic Outlook, May 2021. Organisation for Economic Co-operation and Development, Paris, France. https://www.oecd.org/economic-outlook/may-2021/

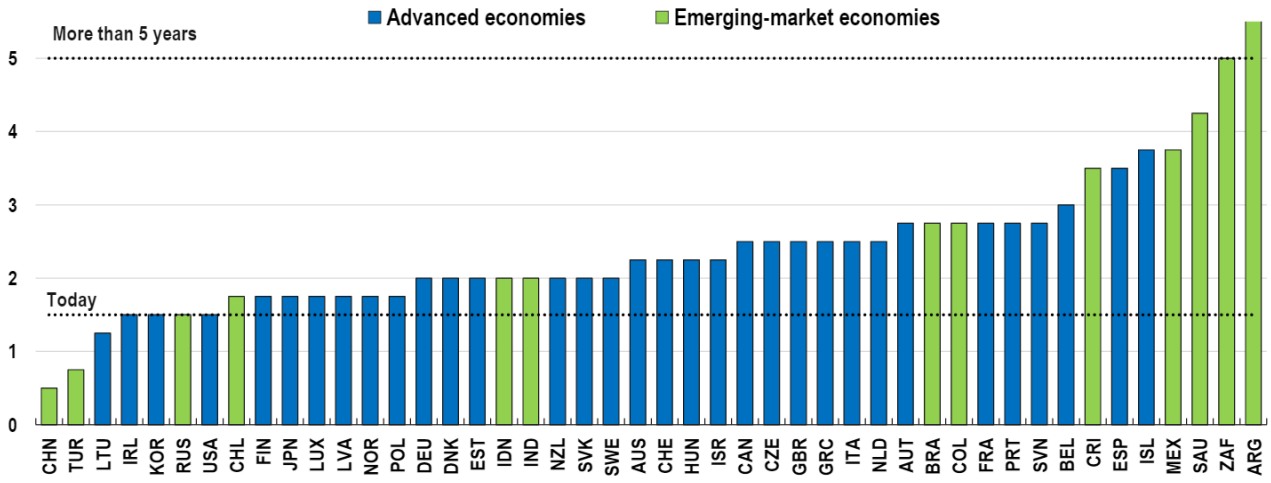


Figure 16 Number of years to recover GDP per capita

Source: OECD (2021), Economic Outlook, May 2021

3.1.3 Macro-trends driving changes in minerals demand

Growth in consumption, manufacturing, agriculture and infrastructure is driving up demand for most minerals. Demand from China is leading, but growth is also evident in Southeast Asia, North America and Europe. Within this demand increase are several trends some of which are well-documented, some less so. These trends are discussed in the following sections.

Economic growth driving consumption, manufacturing and agriculture

As highlighted in the previous section, global and regional economic growth will continue to drive increased household consumption, more manufacturing to meet demand and higher agricultural production. These factors will drive ongoing growth of demand for many minerals. For example, this includes greater agricultural demand for fertilisers and trace elements to enable increased food and fibre production.

At the same time, industries are seeking to operate with lower emissions per unit of output. This includes metals and minerals that enable a lower carbon future across multiple activities and technologies, such as aluminium, magnesium, titanium and graphite due to their light weight and/or particular properties, and/or to use in energy efficient technologies

Growth in infrastructure

As nations become wealthier and as populations and economic activity continue to increase, demand for infrastructure and buildings of all kinds is ramping up. Construction of infrastructure is likely to accelerate as governments seek to stimulate economies to recover from the impacts of COVID-19. China and the rest of Asia are the epicentres of such infrastructure and building investment, though many other regions are expected to follow suit. The United States will spend heavily on infrastructure as part of its economic recovery efforts. Global infrastructure investment will increase demand for construction minerals and metals. The former is required to be sourced close to end-use locations, while demand for construction minerals (for example, steel, copper and aluminium) will tap global markets.

Development Minerals

Minerals for domestic consumption are vital to development. Industries such as construction, manufacturing, infrastructure, and agriculture seek domestically produced minerals. These so-called Development Minerals are just as economically important to local economies as minerals that may be produced elsewhere and have a more direct impact on poverty reduction. Their generally lower price per unit of volume than some other minerals means that they need to be produced close to the location where they are used.

Electrification of household energy systems

Ongoing electrification of energy systems is occurring globally to deliver electricity to energy-disadvantaged communities and reduce local pollution, driving demand for copper, aluminium, steel and other non-fuel minerals. This will drive demand for copper, aluminium, steel, and other non-fuel minerals.

Transition to lower carbon energy sources

As the world moves away from fossil-fuelled energy sources to renewable, lower carbon sources, demand is projected to increase for both traditional minerals and ‘critical minerals’. Part of this shift is to electrification of transport systems, discussed below, while a major component is a change to primary energy sources. This is discussed in more detail in section 3.1.4.

Electrification of transport and other equipment

The growth of electric vehicles use will continue apace with a predicted 135 million vehicles expected to be purchased in the next 10 years[25]. Electric vehicles currently use various versions of lithium-ion batteries. The high efficiency electric motors utilise rare earth elements in magnets as well as copper for windings. Electric cars continue to use steel for construction, increasingly combined with aluminium panels and other components for lighter weight.

Trucks and buses are also being electrified, while new technology light rail vehicles use batteries when not connected to external supply. Heavy and light rail public transport systems in urban centres are overwhelmingly electrically powered.

In the future, hydrogen-powered cars, trucks and buses will be increasingly utilised. Meanwhile, conventionally powered vehicles will continue to utilise lead-acid batteries, the largest single use of lead.

Increasing digitalisation

The growth of digital technologies is also resulting in changes in minerals demand, as well as in the way energy is used. All digital technologies use minerals, with increasing demand for non-traditional elements. The United States Geological Survey[26] has identified up to 13 different minerals in a typical mobile device. USGS says more than one-half of all components in a mobile device are made from mined and semi-processed minerals.

Energy efficient mineral applications

While energy generation and storage are undergoing transformation, so too are the ways energy is used. All users face incentives to use less energy per unit of output. Minerals and metals have vital roles to play in achieving greater efficiency of energy use – from their application in high efficiency aero engines to use in efficient electric motors to use in lighter-weight construction of aircraft and motor vehicles. In industrial energy uses, mining provides a good example: an Australian study[27] found that integrating renewable energy into mining operations, as well as employing energy efficiency measures could reduce at least 40 percent of total current energy use in the crushing and grinding of minerals, which is the most energy-intensive process in mining.

3.1.4 Low carbon transition and minerals demand

The commitments of nations and groupings at the COP 26 climate change conference are expected to accelerate the shift to low carbon energy and electric vehicles, as well as growth in manufacturing of low carbon technologies. This will help drive demand for critical minerals.

The World Bank[28] modelled the impact of shifts in minerals demand in a lower carbon future under several scenarios and found, in summary:

- Clean energy technologies will contribute to rising overall demand for minerals out to 2050, with rising demand for both base and niche minerals;
- Large relative increases in demand of up to nearly 500 percent are estimated for certain minerals, especially those concentrated in energy storage technologies, such as lithium, graphite, and cobalt;
- The way in which the low carbon transition will occur is very difficult to predict, influenced by technology development pathways, policy choices and markets; and

[25] World Bank (2020b), Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition, World Bank Group 2020. https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action
[26] USGS (2016), A world of minerals in your mobile device, United States Geological Survey, https://pubs.er.usgs.gov/publication/gip167
[27] ARENA (2017), Renewable Energy in the Australian Mining Sector, Australian Renewable Energy Agency https://arena.gov.au/knowledge-bank/renewable-energy-australian-mining-sector/
[28] World Bank (2020a), *The outlook for metals: resilience and cautious optimism*

- The future presents both opportunities and risks for mineral-rich countries – opportunities in the form of expanding markets and increased demand, and challenges in terms of meeting sustainability goals with growing minerals production.

The World Bank concluded:

> *Countries that host these minerals are likely to see an increased demand, which, if well managed, could contribute to economic growth and sustainable development. Understanding how demand patterns for these crucial minerals may shift in the face of a new energy system is crucial to long term planning for countries that produce these minerals and deploy renewable energy technologies as part of their national climate ambition.*

Mineral demand vulnerability and risks were also identified by the World Bank:

> *…each mineral may carry different demand risks…for the mining industry and governments, both of which need to be prepared for changes in low-carbon technology deployments, potentially causing large and volatile shifts in mineral demand. Understanding that minerals can have varying demand risks can also provide insight into potential recycling opportunities and needs.*

The International Energy Agency (IEA)[29] has found that deployment of clean energy technologies requires a significant increase in supply of minerals. Many clean energy technologies are more mineral-intensive than traditional technologies and utilise a wider range of minerals, including critical minerals. This represents an opportunity for ASEAN. The IEA says:

> *There is no shortage of resources worldwide, and there are sizeable opportunities for those who can produce minerals in a sustainable and responsible manner.*

The IEA makes six recommendations "for a new, comprehensive approach to mineral security" to enable the clean energy transition:

1. Ensure adequate investment in diversified sources of new supply;
2. Promote technology innovation at all points along the value chain to enable more efficient use of materials, allow material substitution and unlock sizeable new supplies;
3. Scale up recycling to handle rapid growth of waste volumes;
4. Enhance supply chain resilience and market transparency;
5. Mainstream higher environmental, social and governance standards, including incentives for industry players; and
6. Strengthen international collaboration between producers and consumers including a framework for dialogue and policy co-ordination among producers and consumers.

While cleaner energy technologies are more mineral-intensive than fossil fuel technologies, the mix of minerals utilised also changes. For example, large-scale solar generation requires about one hectare of photovoltaic cells per one megawatt of capacity. Silica is the principal raw material used for manufacturing the bulk of cells. Silica is abundant in most regions of the world although purity can vary widely. Copper is major component in some types of cells and for most solar arrays and solar farms.

The advancing technology of thin-film photovoltaic cells, however, uses more exotic and less-abundant minerals such as cadmium, gallium, germanium, indium, selenium, and tellurium.

[29] International Energy Agency (2021), The Role of Critical Minerals in Clean Energy Transitions, May 2021. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions

Wind generation technologies require steel, copper, aluminium, chromium, lead and small amounts of other minerals such as chromium and molybdenum.

Growth of electricity transmission systems will be needed to shift electricity from increasingly diverse locations. This will require increased use of steel, zinc, copper and aluminium.

Batteries for stationery energy storage currently are dominated by lithium-ion technology, also using significant quantities of nickel, cobalt, manganese and/or iron, depending on the chemistry of different types of batteries. In the future, use of vanadium-based redox flow batteries is expected to grow, while other battery technologies could emerge as commercially viable options, such as zinc-air.

3.1.5 Changes in investment patterns

Changes in investment patterns include:

- The rise in investment by firms from China and emerging and re-emerging investor nations;
- Host countries' desire to capture a greater share of minerals value-chains through investment by state-owned and domestic-owned companies, as well as other mechanisms;
- Policies that encourage resource-based industrialisation; and
- Nationalisation of mineral resources development in some important mineral producing countries.

Each of these changes is discussed below.

Emerging and re-emerging investor nations

As China and other nations seek to assure their supply chains of minerals, they are increasingly investing directly in mining projects. Other nations, such as the United Kingdom, EU nations, Canada and Australia, are also investing in support for developing nations to build robust mineral governance standards and systems. Motivations vary, including assurance and diversification of supply chains, supporting economic growth and sustainability in host nations, and creating environments for responsible minerals investment.

Capturing greater benefits from mining and processing

All host countries seek to maximise benefits from mining through various strategies including: facilitating greater involvement of local investors and state-owned enterprises; maximising local content of projects though supply chains and employment; use of mining-oriented infrastructure by others; and maximising government revenue.

Resource-based industrialisation

Most host nations seek to achieve value addition though downstream processing of raw minerals products and concentrates. In some cases, this has involved export bans on lower value products to force processing to occur. Other strategies include developing the mining equipment, technology and services (METS) sector in their jurisdictions. These trends are discussed further in sections 3.4 and 3.6.

Resource nationalisation

Some nations seek to capture even more value and exert control over through effective nationalisation of resources development or carried interests in all minerals projects. This can create challenges for attracting private sector and international investors and the capital, technology and expertise they bring.

Retreat to lower-risk destinations

A recent trend that is impacting on ASEAN minerals exploration and development is a retreat by minerals companies towards lower risk destinations with both high geological prospectivity and high policy prospectivity. Governments in destinations like Australia and Canada have sought to enhance both aspects

of prospectivity through initiatives to enhance precompetitive exploration data and reform of regulations and processes to enable expedited development without erosion of standards. Higher risk destinations, such as ASEAN, are losing market share of exploration investment as a consequence.

3.1.6 ASEAN developments and mineral market opportunities

The ASEAN region provides Members States with strong opportunities in minerals markets. As highlighted in Chapter 20, ASEAN Member States trade more within ASEAN than any other world region. Data in section 2.5.6 showed that investment in the two largest market segments for minerals, manufacturing and construction, is growing rapidly. Output from these sectors is growing, hence demand for inputs, dominated by minerals, energy and human capital is growing at a similar pace. Therefore, ASEAN represents a major current and future demand centre for ASEAN-produced minerals. Conversely, however, lack of investment in minerals exploration and investment will mean ASEAN will require more imports of minerals as in-ASEAN resource discovery and mineral production fail to keep pace with growing demand.

3.1.7 Sustainability in minerals development

Globally, many resource-rich nations and many mining companies are seeking to pursue minerals development that is more sustainable. Sustainable minerals development (SDM) includes:

- Evolving standards for environmentally and socially sustainable mineral development (plus governance), with alignment of minerals development with the Sustainable Development Goals (SDGs), rising community expectations and increased activism focused on responsible resource development, and new standards, including industry standards;
- Ensuring high standards of Environmental, Social and Governance (ESG) performance by project operators and their contractors, greater engagement of communities, local workforces and local businesses, leading to strong flows of long-lasting benefits to communities and economies;
- Mainstreaming gender considerations into all aspects of mine planning, operation and closure in order to minimise negative impacts and maximise benefits;
- A major focus on the rights of indigenous peoples and other vulnerable groups in the context of minerals development, including increasing application of processes to achieve free, prior and informed consent (FPIC) for minerals operations on Indigenous lands;
- A growing industry focus on sustainable mine closure and ensuring positive social, economic and environmental post-mining legacies;
- Increasing focus on the environmental, social and economic dimensions of artisanal and small scale mining; and
- Significant and increasing concern about mine tailings management following recent disasters in Brazil.

Discussion of sustainability imperatives is contained in section 3.7. Discussion of leading practices in international cooperation to facilitate sustainable minerals development is contained in Chapter 4.

3.2 Market outlook for key minerals

There are many analysts covering minerals markets and seeking to predict market trends and prices. Most demand, supply and price outlooks adopt a five-year horizon for reasons of forecasting veracity. The World Bank adopts a 10-year horizon to seek to provide indications of potential price pathways. Longer-term forecasts enter the realm of speculation and should not be relied upon. Nevertheless, assuming an ongoing trend of growth in global population, economy, and household wealth and consumption, it can be expected that demand for minerals will continue to grow beyond 2030. This assumes that any disruptions to growth are transitory and do not reverse trends.

The medium-term (5 year) and long-term (10 year) outlook for minerals demand and hence prices remains robust, if moderated somewhat by expected market stability, assuming no further major global economic upsets. Commodity markets are of course prone to periodic shocks, as exemplified by the impacts of the pandemic and the Global Financial Crisis. Shocks and the impact on minerals markets are discussed briefly in section 3.2.

This section examines price forecasts to 2030 for key mineral products and their precursor raw materials. UQ has used the following data to provide a range of mineral price forecasts based on outlooks for demand and supply:

- S&P Global Market Intelligence[30], which produces consensus five-year estimates from three and up to 30 analysts;
- The Australian Government[31], which produces five-year estimates through the Office of the Chief Economist at the Department of Industry, Science, Energy and Resources;
- The World Bank[32], which produces 10-year price forecasts for major traded commodities including minerals (Table 20). The following subsections discuss in more detail the outlooks for selected minerals.

3.2.1 Copper

The strong Chinese economic recovery is leading to strong growth in industrial production of 6.9 per cent year-on-year (yoy) and a lift in real estate investment (5.6 per cent yoy). This is pushing up both short term prices and forecasts. In addition, the Chinese government's new five-year plan and "Vision 2035" are expected to underpin a return to strong growth and includes transitioning to sustainable demand, renewable energy and technology. Globally, the greening of other economies will also drive demand. Copper consumption and prices are forecast to increase as a result.

Copper prices jumped to well above pre-COVID levels late in 2020, driven by strong demand and restrictions on supply from Latin American producers. Supply tightness is expected to ease in coming years, with new projects coming on stream in Asia, Latin America and Africa. In 2021, copper prices are expected to increase by some 4 per cent. By 2030, prices are forecast to increase by 16 per cent in nominal USD terms; declining by 3 per cent in constant USD terms.

3.2.2 Nickel

Similar to copper, nickel demand is expected to be driven by increased use globally in green technologies and steel. China's economic transition will be a major factor. Demand and prices are forecast to increase as a result.

Nickel prices are the most volatile of the major mineral commodities. Rising nickel consumption and supply constraints from the top two global producers, Indonesia and the Philippines, have combined to push up prices in 2020 and 2021. Out to 2030, nickel prices are expected to the 34 per cent higher than 2020 in nominal terms; or 11 per cent in constant USD terms.

3.2.3 Gold

The current high gold price is driven by global economic uncertainty – and in the US, political uncertainty – as investors seek a safe haven from currency movements. Gold price forecasts are 3 per cent higher in 2021

[30] S&P Global Market Intelligence, Five year consensus estimates of prices of key minerals and coal, S&P Capital IQ, New York, available by subscription

[31] DISR, Resources and Energy Quarterly, Department of industry, Science, Energy and Resources, Australian Government, Canberra. https://www.industry.gov.au/data-and-publications/resources-and-energy-quarterly

[32] World Bank (2020c), Commodity Markets Outlook, World Bank, Washington DC. https://www.worldbank.org/en/research/commodity-markets

than in October 2020 (and 38 per cent higher than in 2019), before softening somewhat from 2024, but to where it is forecast to be still 23 per cent higher than in 2019.

Gold prices rose steeply in 2020 in response to the economic and currency uncertainties caused by the pandemic, leading investors to seek a safe-haven asset. The gold price increased by more than 27 per cent, reaching an all-time high in August 2020. Out to 2030, the price is expected to average down as global stability returns, towards the historically high average of the past decade.

3.2.4 Aluminium

Prices for aluminium have been flat, largely due to oversupply relative to demand, which in 2020 was depressed by the COVID-driven downturn. Longer term, however, demand is expected to rise, driven by manufacture of more lightweight vehicles and increased use in construction. There is a growing market for low-carbon aluminium as manufacturers automobiles, consumer electronics and beverage cans seek to cut greenhouse gas emissions from their supply chains.

After falling by about 7.5 per cent in 2020, aluminium prices are expected to increase by 1 per cent in 2021. Global demand is forecast to recover in 2021, but new capacity, mostly in China, is expected to prevent prices rising further. To 2030, aluminium prices are forecast to rise by 33 per cent in nominal terms or 11 per cent in constant dollar (USD) terms.

3.2.5 Zinc and lead

Demand for zinc and lead is expected to rise by up to 10 per cent by 2024, driven in large part by recovery in Chinese infrastructure spending and manufacturing. Supply is forecast to increase to keep in balance. Therefore, prices are expected to increase only marginally over the next five years.

3.2.6 Tin and tantalum

Tin and tantalum demand is forecast to be steady over the coming five years, with supply competition (notably between China and Indonesia) dampening the immediate price outlook.

Supply disruptions at mines and smelters in Myanmar, Malaysia and Indonesia (plus Bolivia and Peru), together with resilient demand from the electronics sector and some stockpiling have combined to push prices up in the latter half of 2020 from recent lows. Prices are expected to rise from 2024, driven by demand. To 2030, tin prices are forecast to rise by 36 per cent in nominal terms or 14 per cent in constant USD terms.

3.2.7 Lithium, cobalt and other energy transition minerals

Global sales of plug-in electric vehicles (PEV) are forecast to rise 13 per cent to 2.43 million in 2020. In Europe, PEVs now command a market share of 11 per cent, with sales forecast to grow at more than 100 per cent yoy. In China, growth is forecast at more than 70 per cent yoy. PEV sales growth, plus demand for laptop computers and tablets is increasing the demand for lithium ad cobalt for use in batteries. Supplies of lithium and cobalt are different stories, however. Lithium producer response to demand has led to oversupply and a price fall. Lower prices are expected to continue. Cobalt supply is constrained by customer demand for responsible supply chains, which has removed some supply from the market. As a result, cobalt prices are forecast to increase by 31 per cent between 2021 and 2025. Notwithstanding, exploration budgets for battery metals have declined in the past 18 months.

This summary draws on analysis by the Australian Government to 2025 in the absence of a specific World Bank forecast to 2030. This forecast is for lithium consumption to rise by 120 per cent from 2020 to 753,000 tonnes by 2025. Mine production, which already exceeds consumption by 28 per cent, is forecast to grow less fast, but a supply overhang is forecast to lead to only a small increase in real price for spodumene of 2 per cent to 2025.

Longer term, lithium demand is expected to continue to increase, as it will for other minerals used in the energy transition. In 2017, the World Bank projected that by 2050 global production of critical minerals used in low-carbon technologies is projected to rise by 965 per cent for lithium, 585 per cent for cobalt, 383 per cent for graphite, 241 per cent for indium and 173 per cent for vanadium.

3.2.8 Rare earth elements

Along with lithium and cobalt, rare earth elements (REE) are commodities critical to emerging technologies, including green technologies. A key indicator of expected future demand and prices is project financing, which has recovered since March 2020 during the height of the COVID-induced economic crisis. Exploration budgets too have remained strong. That said, the smallest share of exploration for REE is in the Southeast Asia/Pacific region, reflecting lower perceived prospectivity than elsewhere.

3.2.9 Agricultural minerals

Demand for potash and phosphate, both important fertilisers, is expected to increase as agricultural producers seek to increase production. Potash, however, is well-supplied and additional capacity is expected to enter the market in the next five years. Exploration for potash has more than halved over the past five years as a result. Phosphate, too is in oversupply, particularly from low-cost jurisdictions, depressing the price outlook.

Recent price performance of fertilisers is mixed and differentiated between fertiliser products. For potassium chloride, manufactured from potash, which is of most interest to the ASEAN mining sector (notably in Thailand), there has been downward pressure on prices due to oversupply. Nevertheless, growing demand for use in expanding agricultural production is forecast to result in a substantial 22 per cent increase over 2020 levels in constant USD terms by 2030.

3.2.10 Coal

Demand and process for coking coal for steel production are forecast to increase over the next five years as the global economy recovers and as manufacturing and construction ramps up. Notwithstanding the commitment to net zero carbon emissions by around the middle of the century, demand and prices for thermal coal are expected to rise in the medium term.

3.2.11 Natural sand, gravel and crushed stone

Urbanisation and infrastructure are creating substantial demand to supply aggregate (sand, gravel and crushed stone) for the construction and land reclamation sectors, driving environmental change particularly where sand and gravel are sourced from natural waterways.[33] As much as 50 billion tonnes of aggregate are produced from quarries, rivers, lakes and the ocean each year.[34] Little information is available on the nature of this extraction, and regulation and oversight of the sector is weak in many regions.[35] Climate change and disaster reconstruction are creating additional demand for construction materials, while the quarry sector is not sufficiently considered or involved in disaster planning as evidenced by frequent aggregate and cement shortages in hurricane and cyclone reconstruction.[36]

Natural sand, gravel and crushed stone are essential inputs to construction. They are high volume and low value raw materials with costs very sensitive to transport distance. Therefore, sources close to points of use are key to competitive construction costs. Urban sprawl and concern about environmental performance of

[33] Peduzzi, P (2014) P. Environ. Dev. 11, 208–218; United Nations Environment Programme (2019). Sand and Sustainability: Finding New Solutions for Environmental Governance of Global Sand Resources. https://bit.ly/2uxyu6g; Bendixen, M, Best, J, Hackney, C, and Lønsmann Iversen, L. (2019). Time is running out for sand. *Nature* 571, 29-31 https://doi.org/10.1038/d41586-019-02042-4; Franks, Daniel M. (2020). Reclaiming the neglected minerals of development.
[34] Obrien, J. (2019). Aggregates in growth mode. *International Cement Review*, June:46-51.
[35] Franks, D.M. (2020). Reclaiming the neglected minerals of development; UNEP (2019). Sand and Sustainability.
[36] Hailu, D., Ngonze, C. and Franks, D.M. (2019). Minerals in post-disaster reconstruction. United Nations Development Programme. https://bit.ly/2wQS0LW

this mining sector are the main drivers of production of sand and stone being pushed further away from centres of demand.

Table 20 World Bank ten-year estimates of prices of key minerals and coal (nominal US$)

Commodity	Unit	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030
Metals and Minerals														
Aluminum	$/mt	1,867	1,665	1,604	1,968	2,108	1,794	1,660	1,680	1,731	1,784	1,838	1,894	2,200
Copper	$/mt	6,863	5,510	4,868	6,170	6,530	6,010	6,050	6,300	6,374	6,449	6,525	6,602	7,000
Iron ore	$/dmt	97.0	55.9	58.4	71.8	69.8	93.8	107.0	105.0	103.2	101.5	99.7	98.0	90.0
Lead	$/mt	2,095	1,788	1,867	2,315	2,240	1,997	1,820	1,860	1,885	1,911	1,937	1,963	2,100
Nickel	$/mt	16,893	11,863	9,595	10,410	13,114	13,914	13,500	13,800	14,213	14,639	15,078	15,530	18,000
Tin	$/mt	21,899	16,067	17,934	20,061	20,145	18,661	16,900	17,100	17,673	18,264	18,876	19,508	23,000
Zinc	$/mt	2,161	1,932	2,090	2,891	2,922	2,550	2,200	2,300	2,321	2,343	2,365	2,387	2,500
Precious Metals														
Gold	$/toz	1,266	1,161	1,249	1,258	1,269	1,392	1,775	1,740	1,698	1,658	1,618	1,580	1,400
Silver	$/toz	19.1	15.7	17.1	17.1	15.7	16.2	21.0	18.1	18.1	18.1	18.1	18.1	18.0
Platinum	$/toz	1,384	1,053	987	948	880	864	875	870	906	943	982	1,022	1,250
Fertilizers														
Potassium chloride	$/mt	297	296	260	218	216	256	220	228	237	246	256	265	320
Energy														
Coal, Australia	$/mt	70.1	58.9	66.1	88.5	107.0	77.9	57.2	57.8	58.0	58.3	58.5	58.8	60.0

Source: World Bank (2020c), Commodity Markets Outlook, World Bank, Washington DC. https://www.worldbank.org/en/research/commodity-markets

3.3 Exploration trends

3.3.1 Global exploration is rising

Global exploration expenditure for non-ferrous metals globally has tracked metals prices closely for many years.

When the COVID-19 pandemic took hold, however, there was a downturn in mineral exploration activity, as well as some disruption to mineral production in many locations. This downturn was due primarily to movement restrictions introduced by governments and companies, as part of their risk management. Exploration activity has quickly returned to trend levels, however, as explorers adapted to new operating conditions.

Aggregate exploration budgets at US$8.3 billion were 19 per cent higher in 2020 than the low of 2016. S&P Global Market Intelligence[i] reported in March 2021 that its exploration 'pipeline' index in December 2020 reached an almost 9-year high, driven by improvements in financings, drill results, initial resource assessments and projects achieving milestones. S&P expects exploration spending to move back towards tracking metals prices.

Expenditure trends amongst different classes of explorer show that while budgets of major and junior explorers both decreased in 2020, budgets for intermediate explorers increased. Expenditure on exploration by government entities is the smallest category at less than 5 per cent of global expenditure. The majors' share of total expenditure remains at more than 50 per cent.

Markets expect exploration to rebound. Overall mining industry market capitalisation has recovered from the COVID shock and is now 55 per cent higher than the low of March 2020 and at the highest level in more than two years. This was driven by a rebound in Chinese demand and by increases in the price of gold.

The Pipeline Activity Index, an indicator of forward exploration plans, has risen 99 per cent since March. The Exploration Price Index, which measures the relative change in precious and base metals prices, weighted by the percentage of overall exploration spending for each metal as a proxy of its relative importance to the industry has risen 25 per cent since March 2020 and is at its highest level since March 2013.

These trends are confirmed by trends in financings of exploration, despite a downturn in September 2020. Drilling activity, the prime indicator of advanced exploration, has recovered from its low in the June quarter 2020.

S&P Global Market Intelligence predicts rapid recovery of exploration should lead to increases in activity in 2021 compared to 2020.

Of concern, however, is the sustained shift away from grassroots exploration. S&P Global Market Intelligence reports that the grassroots share of exploration fell to 24 per cent in 2020, an all-time low. Meanwhile, the minesite share rose to 41 per cent in 2020, an all-time high. It is grassroots exploration that is the first step to discovering new mineral deposits, while minesite exploration is generally focussed on expanding known resources. Unless this long-term trend is corrected, the opportunities to discover and define new mineral deposits will diminish, inevitably reducing global reserves over time as known deposits are diminished.

This trend is more pronounced in ASEAN. Turning the trend around may provide an opportunity for ASEAN and AMS to market the region and individual companies as highly prospective for greenfields exploration. Of course, this will need to be backed up by action to demonstrate 'policy prospectivity' and infrastructure adequacy as well a geological prospectivity.

3.4 Maximising value along the minerals value chain

Another important objective of amongst mineral-producing nations is to seek to maximise value from mineral development and use. Traditionally (and understandably for governments) the most important component of value has been seen as government revenue, followed by employment. Increasingly though, the concept of value from minerals development is extending across all dimensions and drivers, and over time.
Maximisation of value from minerals development can require activation of some or all of the following value levers. For ASEAN, there may be others in addition.

Financial value to government

- direct revenue – royalties, taxes, and fees and charges
- indirect revenue – from the flow-on economic activity generated by major projects.

Value to national and sub-national economies

- expanded and diversified business activity and economic growth
- value to business from new and expanded business opportunities
- new, additional, and higher skilled employment opportunities
- sustained and sequential value, dampening volatility.

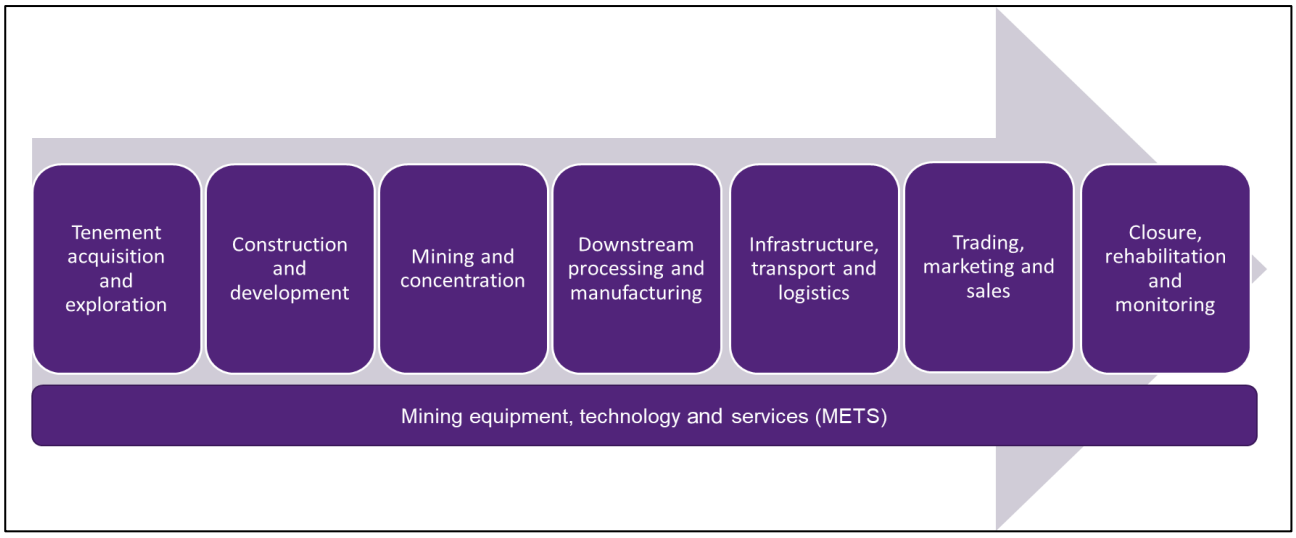


Figure 17 Representation of mineral sector lifecycle and value chain

Whole-of-sector value

- from each part of the minerals lifecycle, from exploration, project planning, project construction, project operation and project decommissioning, plus inputs via the mining equipment, technology, and services (METS) sector (see Figure 17)
- value from processing of raw materials to final or intermediate products, generating new construction and ongoing plant operation activity
- value from growing and deepening the supply and service sector, using enhanced capacity to help attract additional investment in similar projects.

Value from infrastructure and services

- infrastructure constructed for major projects and able to be used by others

- services used by major projects and able to be used by others.

Regional development value

- opportunities for regional business and creation of local jobs
- stimulation of local investment and supply chains
- development of infrastructure that supports regional development and social advancement
- actively facilitate broad-based economic and community development that is not solely dependent on a major project or industry.

Social development value

- new and higher skill employment opportunities that help to sustain regional population and generate pathways for education and training
- through investment and co-investment in social infrastructure and services that enhance liveability
- investment in transport and telecommunications infrastructure that can be used by regional populations
- better local disaster and emergency preparedness, response and recovery capabilities.

Environmental value

- advance environmental knowledge through baseline studies, data collection and environmental assessments
- improve management of the environment utilising greater understanding enabled by government and industry studies
- enable adaptive management of the environment and industry impacts though more timely information.

Strategic value

- positioning a nation or region as major regional producer, processor, and exporter
- positioning a nation or region as key to resource and food security
- positioning a nation or region as a destination for both major investment and investment by small and medium business
- enhancing a nation or region resource security and industrial competitiveness.

Value over time

- generation of value over the short, medium, and long term
- value generation sustained though economic cycles to dampen volatility and underpin steady growth.

Value for industry and business

- building strong, long term community support for responsible mineral development
- building supply and service capacity to enable mineral projects and other sectors to enhance their competitiveness
- through partnerships between industry, governments and community organisations, enhancing liveability to better enable employers to attract and retain high skill employees.

3.5 Measuring the minerals economy

When considering the economic impact of the minerals sector, it is necessary to look beyond extraction of resources to take into account also the sectors providing direct inputs. Research by Australia's central bank in 2013 derived measures of the 'resources economy'[37]. As shown in Figure 18, it found that the Australian resource economy accounts for 18 per cent of Gross Value Added: 11.5 per cent directly from extraction and processing plus 6.5 per cent from other sectors providing inputs. In other words, the resource economy is more than 50 per cent larger than the core sector. In employment, the impact is greater: the Australian Resource economy accounts for 10 per cent of employment: 3.25 per cent directly from extraction and processing plus 6.75 per cent from other sectors providing inputs.

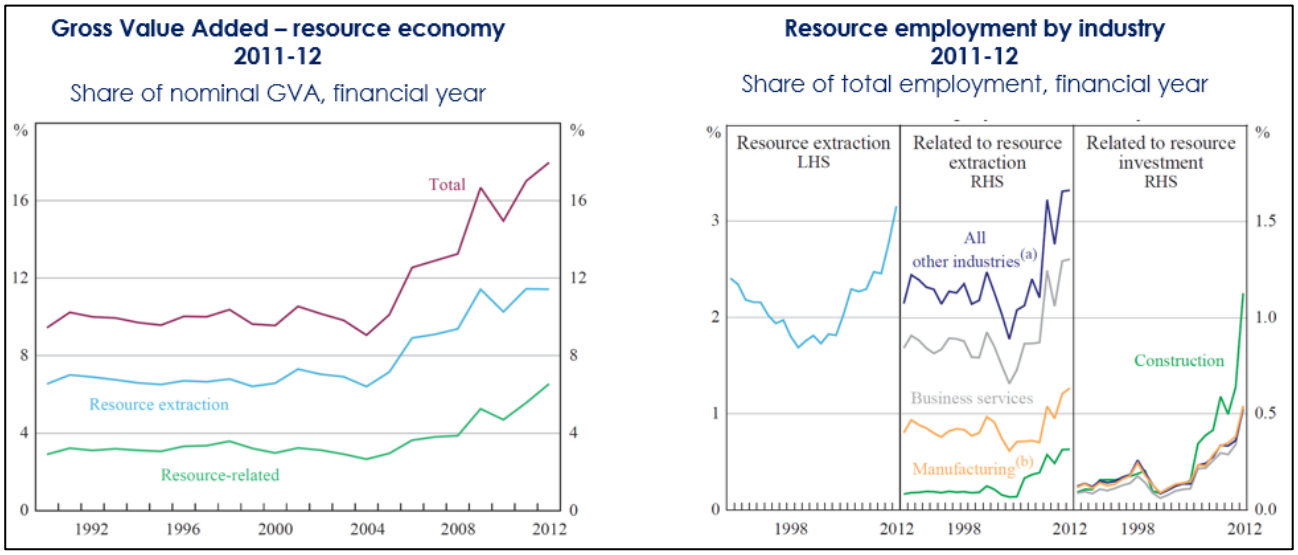


Figure 18 Australian resources economy measures

Source: Rayner and Bishop (2013), Industry Dimensions of the Resource Boom: An Input-Output Analysis, Reserve Bank of Australia, Sydney, February. https://www.rba.gov.au/publications/rdp/2013/2013-02.html

This result is in part due to the strong mining equipment, technology, and services sector in Australia, providing an example to ASEAN of the importance of METS as an economic value vector for the minerals sector.

3.6 The value of a strong METS sector

The mining equipment, technology and services (METS) sector has great potential to be an important pathway to value generation from development of the minerals and energy resources of ASEAN Member States economies. A growing local METS sector can result in development of new, knowledge-rich enterprises, growth in employment, and adoption of technology that can enhance competitiveness and sustainability of the minerals sector and other sectors alike. Building local METS capacity can help attract minerals investment, grow the minerals sector, and develop an important new industry sector that has strong technology and skill spillovers or externalities beyond the minerals sector.

Stronger minerals sector supply chains create opportunities for new and expanded enterprise and employment and enable economies to improve mining operations and standards. Local METS sector suppliers can add value to resources production by providing new, often knowledge-rich pathways for mining

[37] Rayner and Bishop (2013), Industry Dimensions of the Resource Boom: An Input-Output Analysis, Reserve Bank of Australia, Sydney, February. https://www.rba.gov.au/publications/rdp/2013/2013-02.html

to connect to economies. Mining operations that now seek expertise offshore can benefit from stronger local skills and capability. Economies such as Australia, Chile and Canada encourage the METS sector for its direct benefit to mining competitiveness and as an important source of enterprise growth, employment, innovation and revenue. ASEAN Member States nations are well positioned to attract METS investment.

3.7 Sustainability imperatives

Minerals underpin global development and are critical to the achievement of the United Nations Agenda 2030 and the Sustainable Development Goals (SDGs). The extraction, processing, value-addition and use of mineral commodities continues to be characterised by significant environmental, social, and economic challenges. Nearly 20 years have passed since the Global Mining Initiative, led by the International Institute for Environment and Development and the World Business Council for Sustainable Development released the results of a two-year global dialogue on Mining, Minerals and Sustainable Development (MMSD), titled *Breaking New Ground*. The initiative, signalled a shift by the formal mining sector in its approach to sustainable development.[38] Since then, progress has been made on some issues, for some actors, in some places, but much remains to done before mineral production is consistent with societal expectations, acceptable social and environmental standards and global ecological limits.[39]

Global consumption is driving increased demand for minerals. Mineral exploitation has grown markedly over the past century with production of minerals and metals (including mineral fuels and cement) estimated at 65 billion tonnes per annum.[40] Improved resource efficiency and the decoupling of resource use from economic growth and environmental impacts is needed to address the current unsustainable production of mineral resources. In the absence of a significant shift in the mineral intensity of the global economy, achievement of the SDGs will require substantial amounts of mineral resources. Stark increases in the efficiency of resource use, and steep progress toward a circular economy and the use of secondary raw materials are needed to meet both the equity and environmental goals of sustainable development. Consumption is driving the metals industry to expand into new domains (e.g. sea-bed mining; space mining; arctic mining), with governance of these domains lacking or still emerging.[41]

Greater efforts must also be made towards developing a circular economy in the mining sector. This entails not only reprocessing ores, but also the reuse of mining waste and tailings, including end-of-life products such as scrap steel, demolition waste and electronic waste. One example of this is work being done to extract development minerals such as sand from iron ore waste for use in the construction industry. Other examples include extracting cobalt from copper tailings and development of symbiotic relationships between copper miners and industrial manufacturers.

Climate change and the renewable energy transition are driving new demand for minerals. On one hand, the World Bank estimates that graphite (494%), lithium (488%) and cobalt (460%), are expected to experience significant production increases by 2050 to meet the demand created by renewable energy technologies.[42] On the other hand, the International Energy Agency has found that thermal coal mined for the production of electricity is experiencing structural change with price declines experienced between mid-2018 to late 2020,

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[38] International Institute on Environment and Development (IIED) and World Business Council for Sustainable Development (WBCSD; 2002), Breaking New Ground; Mining minerals and sustainable development. The report of the MMSD project. London: Earthscan. http://pubs.iied.org/9084IIED

[39] Responsible Mining Foundation (2020). RMI Report 2020. https://bit.ly/32tDntL; Franks, Daniel M. (2015). *Mountain movers: mining, sustainability and the agents of change*. London, United Kingdom: Earthscan. https://doi.org/10.4324/9781315884400

[40] IRP (2020). Mineral Resource Governance in the 21st Century; Ekins, P, Gupta, J and Boileau, P. (Eds) (2019). *Global Environmental Outlook GEO-6: Healthy Planet, Healthy People*. Cambridge University Press. United Nations Environment. 708p. https://bit.ly/2T0bpCL

[41] Ali, S., Giurco, D., Arndt, N. et al. (2017). Mineral supply for sustainable development requires resource governance. *Nature* 543, 367–372. https://doi.org/10.1038/nature21359

[42] Hund, K., La Porta, D., Fabregas, T.P., Laing, T., and Drexhage, J. (2020). Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition. Washington, D.C., World Bank Group. https://bit.ly/3dyYHCm; Arrobas, D.P., Hund, K.L., Mccormick, M.S., Ningthoujam, J, Drexhage, J.R. (2017). The Growing Role of Minerals and Metals for a Low Carbon Future. Washington, D.C., World Bank Group. https://bit.ly/2TioAhf; World Bank (2018). Mineral Demand Analysis of Energy Technologies Based on IEA ETP 2017 Scenarios. World Bank, September.

as well as mine closures in some regions.[43] This energy shift is accompanied by new environmental and social challenges in the regions where these elements are located. Renewable energy is also becoming an important source of power for the large-scale metal mining industry and there is some evidence of emerging mitigation action by the large-scale metal mining industry to reduce emissions and strengthen climate resilience and adaptation.[44]

The importance of securing supplies for a mineral intensive future is highlighted by the recent adoption of an ASEAN Priority Economic Deliverable (PED) on 'Responding to the Opportunities and Challenges of a Minerals-Intensive Future', under the 2021 chairmanship of Brunei Darussalam.

AMS will inevitably have to confront the challenge of 'complex orebodies', a term that refers to the increasingly complex and challenging contexts that companies and governments must face as high-grade orebodies decline globally. These complex orebodies present a range of challenges that, in addition to lower quality ore grades, include difficult technical, environmental, social and political contexts. Arguably many of these challenges are already present in a number of AMS. Initiatives such as UQ's Complex Orebodies Program is making progress in helping companies and states develop strategies for dealing with these complex challenges.[45]

3.7.1 The shift to ESG frameworks

Recent tailings facility failures and other cases of unsafe working conditions, environmental harm, social conflict, and human rights violations (such as child and forced labour) have furthered distrust of the mining industry and industry-led reform initiatives, and fuelled demands for multi-stakeholder governance, improved monitoring, stronger government oversight, and improved safeguards.

Ethical investors have been active in pushing for reform of environmental, social and governance issues. Weak governance can be a significant driver of business risk, which is one reason that investors place conditions on finance. The IFC Performance Standards (PS) and the Equator Principles (which places standards on mining companies who borrow from private sector banks), in particular, are motivated by the protection of capital from avoidable risk as well as the promotion of responsibility.[46] The PS have been one of the most successful contemporary governance initiatives and, according to one recent survey, amongst the most trusted standards in the sector.[47] More recently, institutional investors have become active on the issues of mine tailings and climate change, such as the Investor Mining and Tailings Safety Initiative and various initiatives of the Principles for Responsible Investment.

3.7.2 Environmental management

Capacity within the mining sector to manage environmental issues has increased over past decades but is still lacking across all scales of mining (large, medium, small and artisanal). Some mining companies have strengthened commitments, and employed sustainability professionals responsible for performance, while many show little progress, with commitments commonly not translated into meaningful change on the ground.[48] Frameworks for water accounting, water recycling, and energy efficiency have been supported at the site-level and industry-wide for member companies of the International Council on Mining and Metals. Government agencies with oversight responsibilities commonly do not have the human and technical capacity to effectively monitor and manage the sector. Artisanal and small-scale mining actors remain largely outside of the development and environment agenda, inhibiting further progress.

[43] Wamsted, D, and Schlissel, D (2019). Coal Outlook 2019. Institute for Energy Economics and Financial Analysis. March. https://bit.ly/3ccuc5m; International Energy Agency (2018). World Energy Outlook 2018. November.
[44] Maennling, N and Toledano, P (2018). The Renewable Power of the Mine: Accelerating renewable energy integration. Columbia Centre on Sustainable Investment, BMZ & GIZ, Energy and Mines. December. https://bit.ly/2Tw2qsb
[45] Sustainable Minerals Institute (2020). Complex Orebodies program. https://smi.uq.edu.au/complex-ore-bodies
[46] Franks (2015), *Mountain Movers*.
[47] World Economic Forum & Resolve (2015). Voluntary Responsible Mining Initiatives: A Review. https://bit.ly/2x20hwE
[48] Responsible Mining Foundation (2020). RMI Report 2020. https://www.responsibleminingfoundation.org/rmi-report-2020/

3.7.3 Social impact management

Public trust in the minerals sector is low. Nearly half of the mining company executives questioned in a recent business survey, for example, identified social acceptance as their top business risk. Unsafe working conditions, environmental harm, social conflict, and human rights violations have created distrust and fuelled conflict between mining projects and their constituent communities. The term social license to operate was introduced by mining companies to describe the business imperative of maintaining positive relationships with communities. Weak governance can be a significant driver of business risk. Ethical investors have been active in pushing for reform of environmental, social and governance issues, in large part due to the potential for the mismanagement of social issues to create poor returns for shareholders. The International Finance Corporation, and a large number of private sector banks have placed conditions on finance (via the IFC Performance Standards and the Equator Principles) to protect capital from avoidable risk as well as promote social responsibility.

A large study conducted by The University of Queensland and The Harvard Kennedy School revealed that conflict between extractive companies and communities can incur costs of roughly US$20 million per week (for mining projects with a net present value of between US$3 billion and US$5 billion).

Both the government and the private sector have important roles to play in the governance, regulation and management of the social dynamics that accompany mining projects. Social Impact Assessment (SIA) is commonly required by governments as part of project approval and voluntarily adopted by leading practice companies as part of corporate policy requirements. SIA can assist government and the private sector identify and respond to social issues associated with developments. In some jurisdictions companies are required to develop Social Impact Management Plans that provide an adaptive management process and framework for guiding ongoing community relationships.

Other tools include community engagement mechanisms and consultative committees, community development agreements and agreement-making between Indigenous Peoples and resource developers, benefit sharing, involvement in environmental and cultural heritage management, employment, and business development. There is increasing application of UN Declaration on Rights of Indigenous Peoples, ILO 169 and recognition of Indigenous land rights including through formal opportunities for Free Prior and Informed Consent. Participatory monitoring, complaints and grievance handling processes. Human rights due diligence and local Development Funds have also been used by leading practice companies, and are required by some governments.

3.7.4 Strong and sound governance

The forms of regulation[49] that shape the governance of minerals are also diverse, and include international legal instruments, international standards, domestic law and regulation, industry standards, corporate standards and policies, multi-stakeholder and civil-society led initiatives, conditions of finance and shareholder activism, social pressure, institutional and individual capacity building. Each location where minerals are mined represents a unique geographical and political setting, whose outcomes are shaped by a wide range of influences.

Oversight of the mineral sector at the state level is in general mixed, but typically insufficient to ensure that the sector contributes positively to the SDGs and avoids harm to people and the environment.[50] Governments have utilized tools such as environmental and social impact assessment, strategic assessment, participatory monitoring, inspections, certification, regional planning, and environmental bonds to understand impacts and ensure proper management.

[49] The term regulation is used here in the broadest sense to refer to the means by which social behaviours are influenced and controlled, rather than the more specific meaning as the promulgation of rules to enforce laws. See Koop C., and Lodge, M. (2017). What is regulation? An interdisciplinary analysis. *Regulation and Governance* 11(1):95-108. https://doi.org/10.1111/rego.12094

[50] IRP (2020). Mineral Resource Governance in the 21st Century.

A poor governance environment has been demonstrated to detract responsible investors from jurisdictions and leave only those tolerant of a high-risk operating environment, simultaneously constraining the opportunities of development from minerals and exacerbating environmental and social problems.[51] Pressure to maintain an 'attractive investment climate,' in some jurisdictions has meant reducing environmental and social obligations on mineral developers. Corruption has also played a role in undermining the state's capacity to regulate in some countries.

Coordinated action by governments can assist to overcome the challenges faced by individual governments in isolation. Frameworks like the Africa Mining Vision and gatherings like the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), promote alignment across jurisdictions to simultaneously lift standards.[52]

Governance is not a top-down, sole responsibility of government. It should and must involve all participants to be effective. Minerals governance can be defined[53] as:

> *The necessary blend of (1) law and regulation; (2) government administration, monitoring and enforcement; (3) community engagement; and (4) voluntary private sector practices that enables:*
>
> - *Government to host responsible private sector investment in mining*
> - *Mining to be conducted sustainably*
> - *Benefits to be delivered to nations and regions, their economies and their communities*
> - *Investors to derive commercial returns.*

Stakeholders include national and regional government, domestic and foreign owned mining companies, civil society organisations, industry associations, and education and research institutions.

Minerals governance encompass interactions of stakeholders throughout the mining lifecycle – from investment policy, precompetitive exploration data collection and tenement administration; to mining approvals and regulation, revenues, monitoring and external impacts; to mines closure, post mining land use and post mining economic activity.

Nations that host well-governed minerals sectors tend to:

- Attract investment of higher quality and value
- Achieve better financial returns
- Achieve better economic, social and environmental outcomes.

This is because investors' risk profile is significantly reduced – sovereign risk, regulatory risk, financial risk and social licence risk. As well, such countries have policies and mechanisms that enable local businesses and communities to connect with mining activities to derive economic and social benefits, while mitigating detrimental impacts.

3.7.5 Responsible sourcing

The geopolitical dimension of raw-materials supply continues to be a focus for many countries. More than 50 countries have set restrictions or duties on raw material exports,[54], while a number of importing countries have initiated programs to track the supply risks of critical minerals and have applied import restrictions to

[51] Franks, DM, Davis, R, Bebbington, AJ, Ali, SH, Kemp, D, Scurrah, M. 2014. Conflict translates environmental and social risk into business costs, *Proceedings of the National Academy of Sciences*. 111(21): 7576-7581; Otto, James M. (1992), 'Criteria for assessing mineral investment conditions.' Mineral Investment Conditions in Selected Countries of the Asia-Pacific Region. ST/ESCAP/1197, United Nations, New York; Tole, L. and G. Koop (2011), 'Do environmental regulations affect the location decisions of multinational gold mining firms?' *Journal of Economic Geography*, 11(1), 151–177.
[52] Franks (2015), *Mountain Movers*.
[53] IM4DC (2013), *Annual Plan 2013-14,* International Mining for Development Centre, Perth
[54] OECD (2019), *Methodological note to the Inventory of Export Restrictions on Industrial Raw Materials*, https://bit.ly/3cp0ZUh

ensure responsible and conflict-free production practices. Investment in clean resource processing as part of green industrialisation could simultaneously encourage domestic value addition, assist the diversity of mineral supply, and support the structural transformation of mineral endowed economies.

Supply-chain due-diligence and certification initiatives are providing market information for consumers to consider ethical alternatives, particularly in the jewellery industry. Responsible production, conflict and supply security are the predominant thematic issues shaping supply chain due diligence approaches, while issues related to environment and development are under-emphasised. Due diligence approaches applicable to artisanal and small-scale miners are predominantly focused on international supply chains, overlooking the potential for integration of ASM into domestic supply chains and the production of minerals needed for domestic development.

Chapter 4: Minerals cooperation experience

Key findings

- Numerous regional cooperation initiatives have addressed issues of relevance to ASEAN, especially in the areas of trade and investment barriers; coordinating minerals mapping and research efforts; and Environment, Social, Governance issues (ESG), including the Africa Mining Vision (AMV), Asia Pacific Economic Cooperation (APEC), Economic Community of West African States (ECOWAS), OECD Policy Dialogue, and Southern African Development Community (SADC).
- The Africa Mining Vision stands out as promising model that can provide learnings for enhancing cooperation between AMS across a wide range of thematic areas, given its comprehensive nature, the way in which it has been tailored to the needs and circumstances of the region, and establishment of a dedicated centre to oversee operational matters, thereby ensuring sustainability and progress in implementation of Action Plans.
- Numerous topical cooperation initiatives have addressed issues of relevance to ASEAN such as documenting and harmonising mineral laws, mapping, exploration, capacity building/training especially the African Mining Legislation Atlas (AMLA), EU-Latin America Mineral Development Network Platform (MDNP), PanAfGeo, the West African Exploration Initiative (WAXI) and the South American Exploration Initiative (SAXI).
- Trade and investment barriers are addressed by APEC's STAR database, the African Mining Legislative Atlas, SADC's Framework for Harmonization, the ECOWAS Model Mining Law, OECD Policy Publications, and the EU-Latin America Mineral Development Network Platform.
- Mineral mapping and exploration are addressed by Critical Minerals Mapping Initiative, PanAFGeo, and WAXI/SAXI.
- ESG issues are addressed by AMLA, APEC, MDNP, SADC, and PanAfGeo.
- Several best practices include databases providing detailed and comprehensive information on mining legal frameworks, mineral potential, exploration opportunities, and available funding instruments, such as the APEC STAR, EU-Latin America MDNP, CMMI, and AMLA.
- Several regional cooperation initiatives have implemented model mining and mineral laws derived from harmonising principles they developed, including ECOWAS and SADC.

4.1 Overview of cooperation initiatives

A total of 35 mineral cooperation initiatives have been analysed for this study. These are categorised into four types:

- Regional mineral cooperation initiatives;
- Regional topical mineral initiatives;
- NGO initiatives; multilateral / bilateral programs; and
- Programs run by bilateral donor countries/ aid agencies.

Key learnings and elements of leading practice have distilled for consideration in the ASEAN context. The recommendations in this report reflect the findings.

The initiatives range in geographic focus from Africa, Asia, Pacific, North and South America and the Caribbean. Thematic issues include sustainable development, inclusive growth, value-addition and structural transformation, geosciences, mineral law, mineral supply security, investment, conflict, revenue management and exploration. The majority of the initiatives are implemented by an intergovernmental agency, followed by

government agencies, independent organisations, UN agencies and university consortiums. Activities include capacity building, policy alignment, knowledge building, knowledge exchange, revenue transparency and reporting, technical support, research, and education.

4.2 Case studies of minerals cooperation

Case studies were selected from the list of 35 cooperation initiatives, with a focus on regional mineral cooperation initiatives and regional topical initiatives. They were chosen due to their similarity or applicability to the principles of the AMCAP. Widely dispersed regions of the world were selected for the most comprehensive overview including Africa, Latin America, and Asia. It is not a coincidence that Africa has the most initiatives, due to its enormous mineral wealth and unfulfilled potential. Similar themes to AMCAP are found in all of the initiatives including trade and investment, sustainable mineral development, institutional and human capacity building, and database development.

A summary of leading practices and lessons learned is provided in section 4.3.

4.2.1 Regional mineral cooperation initiatives

- Africa Mining Vision (AMV)
- Asia-Pacific Economic Cooperation (APEC)-Mining Task Force
- Economic Community of West African States (ECOWAS) Mining Provisions
- OECD Policy Dialogue on Natural Resource-based Development (PD-NR)
- Southern African Development Community (SADC) Protocol on Mining.

4.2.2 Topical mining cooperation initiatives

The following mineral cooperation initiatives focused on specific (topical) issues are explored in the case studies below:

- African Mining Legislation Atlas (AMLA)
- Critical Minerals Mapping Initiative (CMMI)
- EU - Latin America Mineral Development Network Platform (MDMP)
- Pan-African Support to the EuroGeoSurveys (PanAfgeo)
- West African Exploration Initiative (WAXI)/South American Exploration Initiative (SAXI).

4.3 Summary of leading practices and lessons learned

In feedback on the DPAMC Interim Report, ASEC-EMD suggested that “ASEAN would benefit from the case studies focusing on thematic areas of explorations, value additions and structural transformation, investment and mineral law, coordinating minerals mapping and research effort.” Taking this feedback into account, the UQ team has organised the case studies into four thematic areas in order to identify leading practices and / or lessons learned that can be taken into consideration in the design of future minerals cooperation strategies. Along with ESG, additional issues identified during the research have also been included in thematic areas:

- Barriers to trade and investment barriers: policy and regulation, opaque and complex legal system, and taxation/royalty regimes;
- Coordinating minerals mapping and research efforts; lack of quality geological data; exploration;
- Value additions and structural transformation; and

- Environment, Social, Governance Issues (ESG); difficulty obtaining social license; limited human capital.

4.3.1 Barriers to trade and investment: policies and regulations, opaque and complex legal system, and taxation/royalty regimes

Asia-Pacific Economic Cooperation (APEC) Mining Task Force[55]

Leading practices

The APEC Services Trade Access Requirements (STAR)[56] is a comprehensive database providing information on:

- Limits on foreign investment
- Licensing and approval procedures
- Restrictions on scope of service
- State owned enterprises
- Tax treatment
- Restrictions on type of legal entity.

This database provides a thorough listing of legal issues for every country in APEC. Seven out of ten ASEAN countries are already members of APEC. Only Cambodia, Lao PDR, and Myanmar are not members of APEC. The database is not currently being updated but is something that ASEAN could consider utilising and building upon.

Lessons learned

- Countries with less mining resources often did not attend meetings, resulting in lack of a quorum, which ended the initiative.

The African Mining Legislation Atlas (AMLA)[57]

Leading practices

- Many national mining laws are difficult to get and hard to access, and AMLA increases transparency by making these laws available publicly to students/academics, investors, governments, and civil society organizations.
- AMLA is updated annually making the information up-to-date at all times.
- The AMLA database provides a platform for comparative analysis of laws in different countries, while also promoting harmonization of laws.
- Proof of the initiative's success is a request to duplicate AMLA for the petroleum industry.

Lessons learned

- Legal transparency can be achieved by use of a coordinated database
- Having a legal database can encourage harmonization of mining laws
- The legal database fosters human capacity building of legal professionals.

[55] Further information at https://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Mining
[56] See https://www.apec.org/Publications/2017/04/APEC-Services-Trade-Access-Requirements-STAR-Database
[57] Further information at www.a-mla.org

Southern African Development Community (SADC) Protocol on Mining[58]

The SADC provides a framework for the harmonisation of mining policies, standards, legislation and regulations in Southern Africa. Its Harmonisation Implementation Plan has eight themes or areas of work grouped into categories of related activities:

- Mineral policies
- Political, economic and social environment
- General investment environment
- Mining fiscal environment
- Minerals administration and development systems
- Artisanal and small-scale mining
- Research and development
- Human resources and skills development
- Gender.

Lessons learned

- Harmonisation of mining policies, standards, and legislative and regulatory frameworks increases transparency and spurs investment.
- Holding public investment forums can enhance cooperation and increase bilateral agreements leading to greater investment.
- Adopting certification policies such as the Kimberly Process enhances peace and security.

Economic Community of West African States (ECOWAS)[59]

Leading practices

The main best practice from ECOWAS is its Model Mining and Mineral Act based on Harmonizing Principles developed by the initiative. This Directive outlines eight (8) guiding principles for the mining sector including:

- Minerals as State resources (vesting of mineral resources in the state, acquiring mineral rights etc.)
- Protection of the environment (environmental protection obligations)
- Protection of national interest (stability agreements, fiscal framework etc.)
- Access to Information (duty to maintain records, transparency, good governance, public access to information etc.
- Human rights obligations and mining activities (human rights obligations, sustainable development and local community interests etc.)
- Dispute resolution (complaints procedure, settlement procedures etc.)
- Institutional and Implementation Arrangements (focus of member states, the president of ECOWAS Commission etc.)
- General and final provisions (general provisions, publication, difficulties of implementation etc.).

[58] Further information at https://www.sadc.int/themes/economic-development/industry/mining/
[59] Further information at https://www.ecowas.int/

OECD Policy Dialogue on Natural Resources-based Development[60]

Leading practices

- *Guiding Principles for Durable Extractive Contracts* – endorsed by the Governing Board of the OECD Development Centre on 10 February 2020[61]
- *Framework for Extractive Projects on Collaborative Strategies for In-Country Shared Value Creation*[62]
- *PD-NR Compendium of Practices*[63].

Lessons learned

- Barriers to investment may include a lack of adequate regulatory framework and a lack of trust between the parties. In terms of the regulatory framework, it is important that contracts are aligned with the long-term vision and strategy defined by the host government on how the extractive sector can fit into and contribute to broader sustainable development objectives.
- Transparency of the legal framework provides an important safeguard for foreign investors and should help ensure effective use of the resources for public benefit.
- The negotiation and signature of extractive contracts is just the starting point of a long-term relationship between the host governments and investors, requiring mutual engagement, transparency and accountability, and clear articulation of respective roles and responsibilities to achieve common objectives.
- Effective engagement and constructive consultations can help to foster the trust of local communities and Indigenous peoples, which is a vital foundation for achieving realistic expectations and understanding.
- A lack of trust can be exacerbated by the asymmetry of information that ordinarily exists between investors and governments. Consequently, the sharing of information between host governments and investors on qualified estimates of the resources, development costs and scenarios, production profiles, and closure/decommissioning liabilities can help build a shared understanding. This allows the stakeholders to share common assumptions for defining the economic equilibrium of the contract as well as in the design of the revenue allocation mechanism to sustain the viability of the project throughout its life-cycle.

EU - Latin America Mineral Development Network Platform (MDNP)[64]

Leading practices

- The digital MDNP provides to its members structured information on the mining legal frameworks, the mineral potential, the exploration opportunities, and the available funding instruments
- The platform provides a meeting point for companies to share technology, equipment, services, and infrastructure, and also to academia organisations, R&D&I projects and funding instruments.

Lessons learned

- It is important to have a steering committee formed by members from all the countries, enabling agreement on the roadmap, the specific actions and the information shared on the digital platform.

[60] Further information at https://www.oecd.org/dev/natural-resources.htm
[61] Available at https://www.oecd.org/dev/Guiding_Principles_for_durable_extractive_contracts.pdf
[62] Available at https://www.oecd.org/dev/Framework_Public-Private_Collaboration_FINAL.pdf
[63] Available at https://www.oecd.org/dev/policy-dialogue-on-natural-resource-compendium.htm
[64] Further information at https://www.mineralplatform.eu/

4.3.2 Coordinating minerals mapping and research efforts; lack of quality geological data, exploration

Critical Minerals Mapping Initiative (CMMI)[65]

Leading practices

- Identifies knowledge gap, shares data and expertise, enhances working relationships
- Unifies critical minerals analyses from all three countries and promotes a collective understanding
- Builds upon existing datasets for use in critical mineral assessments
- Global Digital Database: The primary product of this collaboration is the Global Digital Database since the distribution of critical minerals in ore deposits is poorly understood.

EU - Latin America Mineral Development Network Platform (MDNP)

Leading practices

- The digital MDNP provides to its members structured information on the mining legal frameworks, the mineral potential, the exploration opportunities and the available funding instruments
- In the field of mapping and exploration activities, an exchange of knowledge and experience has started between the Geological Surveys of Latin America and the Geological Surveys of Europe.

West African Exploration Initiative (WAXI) / South American Exploration Initiative (SAXI)[66]

Leading practices

- Synthesises mapping, geo-research, geology data across country borders that would be otherwise unavailable due to geographical and language barriers
- Data made available to geological surveys, donating companies, and universities only. Information to the public is only available through academic papers.

Lessons learned

Work slowly to develop trust since geological surveys may fear losing their data. Pre-competitive sharing of information is beneficial to everyone. Maintain confidentiality to develop trust.

4.3.3 Value additions and structural transformation:

Very little was reported in this thematic area.

4.3.4 Environment, Social, Governance Issues (ESG); difficulty obtaining social license; limited human capital

The African Mining Legislation Atlas (AMLA)

Leading practices

- Provides capacity building through training (on-ground and remotely) of African legal professionals in the use of the platform and on overall issues in mining law.
- AMLA goes beyond mining laws by also including related laws such as environmental, land use, and community engagement laws, and includes contracts and membership in initiatives such as EITI.

[65] Further information at https://www.usgs.gov/centers/gggsc/science/critical-minerals-mapping-initiative-cmmi?qt-science_center_objects=0#qt-science_center_objects

[66] Further information on WAXI at https://www.tectonique.net/waxi3/ and on SAXI at http://saxiproject.org/

Lessons learned

- Legal transparency can be achieved by use of a coordinated database
- Having a legal database can encourage harmonization of mining laws
- The legal database fosters human capacity building of legal professionals.

Africa Mining Vision (AMV)[67]

Leading practices

- Promotion of gender justice
- Supporting the principle of free, prior and informed consent (FPIC)
- Promoting a progressive fiscal regime
- Elevation of artisanal and small-scale mining (ASM) into national mining policy.

Lessons learned

- Preferential trade agreements can overcome market liberalization
- Publicise the initiative more to get broad-based participation
- Expand environmental regulations to cover the full mine lifecycle
- Include civil society and mining communities in decision-making
- Expand transparency for contracts, geological surveys, policies and other revenues.

Asia-Pacific Economic Cooperation (APEC) Mining Task Force

Leading practice

- Project database: The focus on ESG projects was a best practice in achieving goals of sustainability.

EU - Latin America Mineral Development Network Platform (MDMP)

Leading practice

- The platform is promoting to its members corporate social responsibility, social license to operate, and the EU-Latin America mining sector contribution to the Sustainable Development Goals.

Lesson learned

- These ESG goals may be broadly accepted in civil society but governments and mining companies may be slower to adopt them. Universal promotion among all members of the platform enhances their uptake.

Southern African Development Community (SADC) Protocol on Mining[68]

Leading practice

- In 2003, the Kimberly Process Certification Scheme was launched, ensuring the implementation of a series of United Nations Security Council resolutions and sanctions on trade in conflict diamonds. The Kimberly Process is globally recognized as a best practice in the mining industry. Recommendations: extend the Kimberly Process to encompass illegal trade in other minerals.

[67] Further information at https://au.int/en/ti/amv/about
[68] Further information at https://www.sadc.int/themes/economic-development/industry/mining/

Pan-African Support to the EuroGeoSurveys - Organisation of African Geological Surveys [EGS-OAGS] Partnership) (PanAfgeo)[69]

Leading practices

- Over 3 years (2017-2019), PanAfGeo provided training for about 1200 geoscientists to provide access to high-level geological knowledge through 49 courses organised in different parts of Africa to ensure the right balance in terms of geography and languages. The courses covered eight topics: geological mapping, mineral resources and mine inventories, small-scale mining, environmental management, natural risks, the geological heritage, geoscientific data management and communication.

West African Exploration Initiative (WAXI)/South American Exploration Initiative (SAXI)

Leading practices

Provides the following capacity building, which greatly expands the capacity of mining company staff and university students in geosciences, mapping and use of exploratory data:

- Training courses for company staff in geosciences
- Education of university geosciences students preparing them for industry, government, or university research
- Making data available to stakeholders.

[69] Further information at https://panafgeo.eurogeosurveys.org/

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