What Makes Minerals Critical?: Global Supply Chain Priorities Under Review

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Abstract

Critical Minerals are considered essential by nations to enable a transition towards a cleaner economy. These minerals such as lithium, cobalt, nickel, and rare earth elements are used in batteries as an alternative to traditional fuels. As is the case with traditional fuels, there are a few countries having sufficient resources and endowments of these critical minerals. Additionally, this space is dominated by a few countries in terms of processing capacity. Similarly, asymmetries apply to other aspects of critical minerals supply chains, especially technology verticals. The scarce distribution of critical minerals and concentration of processing capacity, coupled with a race to secure these minerals for domestic needs, has alarmed various countries to group together or take steps at an individual level to diversify critical mineral supply chains. According to a database maintained by the International Energy Agency, the Asia-Pacific is one of the most vibrant regions in terms of introducing policies for critical minerals. There are a myriad of unilateral initiatives in the Asia-Pacific and in some other regions connected through one or the other plurilateral frameworks, and the ones which stand out are China, Japan, Australia, US and the EU. India, Indonesia, Malaysia, Thailand, and Vietnam have also increased their unilateral initiatives and participation in various global dialogues. These initiatives have significant potential in terms of redefining the critical minerals supply chain. These plurilateral initiatives, for instance, are witnessing a new era of cooperation and joint initiatives in this area. A key question is: do all these countries share a collective understanding of which material or mineral is critical? Furthermore, the workings of multilateral initiatives like the MSP and the IPEF Working Group on Critical Minerals, are not transparent. The paper aims to examine to whether a collective understanding of critical minerals exists; analyse the approaches taken by major Asian economies, as well as global players like the US and the EU, which are part of plurilateral initiatives wherein Asian countries play a significant role; and the potential implications of these initiatives in terms of reshaping the supply chain of critical minerals.

Keywords: Supply Chain, Unilateral Measures, Domestic legal instruments, Asia-Pacific, ASEAN

1. INTRODUCTION

The transition to a clean economy has led to a race among various countries to secure the supply of certain "critical minerals" essential for various green energy technologies.[1] This race is fuelled by the demand-supply gap for various minerals and raw materials that are considered essential for a transition towards a cleaner economy and is characterised by the emergence of various domestic instruments, unilateral actions, innovations in bilateral agreements, and numerous plurilateral initiatives. While the intention to secure the supply of various raw materials perceived as "critical" is potentially tied to the transition towards a cleaner economy, the understanding of "criticality" may not be a shared understanding among various countries. This is essentially an individual state's determination based on its own domestic priorities. This is evident from the listing of particular minerals under various plurilateral initiatives. While

[1] This race is fuelled by the demand-supply gap for various minerals and raw materials that are considered essential for a transition towards a cleaner economy and is characterised by the emergence of various domestic instruments, unilateral actions, innovations in bilateral agreements, and numerous plurilateral initiatives. See IRENA, *Geopolitics of the Energy Transition: Critical Materials – 2. Trade, Security and Interdependence* (IRENA 2023) https://www.irena.org/Digital-Report/Geopolitics-of-the-Energy-Transition-Critical-Materials#page-2 accessed 28 March 2026.

there is a scientific understanding on what is a mineral; the crux of the issue lies in criticality. The "criticality" of a mineral is state determined, and at present the prevalent approach to identify critical minerals is primarily based on national requirements. In the below sub-section, we briefly trace the genesis of "critical minerals" and the initial concept of "criticality".

The Genesis of the term critical minerals

Critical minerals have been with the concept of national defence and security. One of the first legislations on this end was the US Strategic and Critical Materials Stockpiling Act of 1939.[2] The discussion at that stage concerned the US focus on facing resource shortages due to geopolitical developments and the start of World War II.[3] Despite origins in the idea of stockpiling or maintaining reserves in times of war where extraordinary demands are raised, the act of designating minerals/materials as critical or strategic has evolved significantly. Most contemporary understandings of critical minerals focus on the following factors:

(i) Availability risks: i.e when the supply of a mineral is subject to resource availability challenges;
(ii) Supply Chain Vulnerability: i.e propensity of the mineral to be subject to restrictions of supply which can emanate from contingencies like geopolitical tensions/rivalries, armed conflicts *inter alia* or economic measures that generate extraterritorial impacts such as China's alterations to its export and production quotas;
(iii) Technological Factors: Accounting for extensive future use on account of relevance in particular sectors: i.e utilization by growing sectors like technology, transport, defence and clean energy segments, all of which need particular minerals for their respective supply chains. This also includes existing technological divide in this domain, and a desire to lead technological advancement with a view to ensure security of supply chain.[4]

A relevant aspect to consider with respect to (ii) since the 90s is the predominant position of China in the supply chain which pushed up to 95 per cent in the early 2000s and saw some disruptions due to internal policies of production and export related quotas adopted by China.[5] With respect to (iii) there are also overlaps in terms of identified minerals wherein they may be used for both defence and civilian applications, creating a classic case for dual use goods which can generate multifaceted implications. The military use aspect can lead to increased regulation and monitoring and can also be subject to restrictions. Regardless, critical minerals trade is witnessing increased unilateral and plurilateral policy and legal interventions that have

[2] See Segura-Salazar, J., & Tavares, L. M. (2018). Sustainability in the minerals industry: Seeking a consensus on its meaning. *Sustainability*, *10*(5), 1429. doi.org/10.3390/su10051429; See also U.S. National Research Council. Minerals, Critical Minerals, and the U.S. Economy; The National Academies Press: Washington, DC, USA, 2008; ISBN 9780309112826; Hayes SM and McCullough EA (2018), Critical Minerals: A Review of Elemental Trends in Comprehensive Criticality Studies. 59 Resources Policy 192. https://www.sciencedirect.com/science/article/pii/S0301420718301296. Accessed 13 November 2025
[3] See US Public Laws, 1939. Strategic and Critical Materials Stock Piling Act. Chapter 190. http://legcounsel.house.gov. Accessed 5 December 2025
[4] Dou Shiquan and Xu Deyi (2022)
[5] US Public Laws, 1939.

the potential to significantly reshape the present "fragile" supply chain.[6] Our paper aims to explore the concept of "criticality" in prominent Asian economies and influential plurilateral forums. In order to understand how various they have developed an understanding of critical minerals. We first examine domestic policy rationales, approaches, and methodologies for the development of a list. Our research is limited to major Asian economies, but we also look at a few other countries as they feature prominently in significant plurilateral initiatives in this domain. In part III of this article, we also peruse various bilateral and plurilateral initiatives as normative frameworks relevant for understanding and even defining critical minerals. This includes examination various preferential trade agreements, plurilateral forums such as the "Mineral Security Partnership", and the "Indo-Pacific Economic Framework Agreement on Supply Chain". With this endeavour, our objective is to establish if common understandings on critical minerals is possible. We also attempt to recommend how a collective understanding can emerge from the preceding analysis.

What makes Raw Materials Critical?

In this section, we examine various domestic policy and legal instruments to trace the origin and development of country-level understandings of what critical minerals are.

In this regard, we seek to understand the development of "criticality" in select states in the Asia Pacific which includes, Australia, the US and Asian jurisdictions of relevance in critical mineral value chains. In addition, we also examine the EUs law and policy regime as it provides a detailed understanding of regulation of "critical raw materials[7]". The EU is also relevant on account of its extensive trade engagement in the Asia Pacific region through free trade agreements (FTAs).

The objective of this enquiry is to understand different ways in which the idea of criticality has been linked with certain mineral resources in contemporary times. Secondly it also provides various approaches that are domestically prevalent in understanding criticality in the region. Finally, it also explores the link between resource criticality and end uses including inter alia clean energy transitions, emerging technology, defence and aerospace needs or just generally fostering economic growth of a state in a particular direction through the utilisation of mineral resources.

Critical, strategic or Clean energy transition minerals: Dealing with distinctions on internal terminologies in US, EU and Australia

Critical minerals lists are based on criticality assessments.[8] These assessments are determined by states through an identification process with multiple factors as important variables. Some common factors, in the context of critical minerals, deal with questions surrounding: security of supply (with respect to states that depend upon imports of raw, processed or finished products; leveraging resource/capability (in areas like processing) globally to foster economic

[6] Snoussi-Mimouni, M. & Avérous, S. (2024) High demand for energy-related critical minerals creates supply chain pressures. https://www.wto.org/english/blogs_e/data_blog_e/blog_dta_10jan24_e.htm. Accessed 7 December 2025

[7] Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024, art 2(60), OJ 2024

[8] Smith et. al. (2025).

growth; supporting security of supply in allied/partner states; improving/maintaining standing amongst states in domains specifically featuring but not limited to emerging technologies in the digital sphere, defence and clean energy transitions.[9]

Multiplicity of factors can be an overwhelming challenge for states when engaged in the act of classifying some resources as more important than others. Creating sub classification within these hierarchies is an interesting response to this challenge. A pertinent example of this approach is the EU which creates sub classifications by locating Strategic Raw Minerals (SRMs) within the subset of Critical Raw Materials (CRMs).[10] CRMs have been defined as components which are at the highest supply risks while also being of immense economic relevance.[11] SRMs is a category which is oriented more towards defence, clean energy transitions, space and digital transitions.[12]

Interestingly, Australia adopts a related but distinct approach where there are overlaps between Critical and Strategic Minerals but the latter may include components which are not in the former. For instance, the 2024 list excludes the strategic minerals: aluminium, copper, phosphorus, tin, and zinc from the critical minerals list as their supply chains do not seem endangered enough.[13] The Australian focus in its lists is to create distinct categories of minerals with one focusing on the supply chain vulnerability side (Critical Minerals)[14] and another with a focus on minerals based on their application/utility (Strategic Minerals)[15].[16] It is pertinent to note that with respect to Australia the focus is not just domestic access but also an attempt at leveraging Australia's resource endowments to global supply chains for economic and strategic benefit.

There are also possibilities of sector specific minerals lists as opposed to stating an all-in-one listing approach.[17] While these aspects are rare, they present another set of problems as multiplicity of lists within the national/sub national space may make international cooperation difficult. It may also lead to redundancies on account of overlap with other lists or exclusions of mineral resources from important lists.[18]

The US, on the contrary, has a differing understanding of critical minerals based on departmental focus. A general approach to critical minerals also seems fragmented in terms of

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[9] Smith et. al. (2025).
[10] See Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024, art 5(2), OJ 2024; See also Blot, E. (2024), Sourcing critical raw materials through trade and cooperation frameworks. Institute for European Environmental Policy. https://ieep.eu/wp-content/uploads/2024/03/Sourcing-critical-raw-materials-through-tradeand-cooperation-frameworks-IEEP-2024.pdf. Accessed 5 December 2025
[11] Montana et al. (2024)
[12] Montana et al. (2024)
[13] Australia Department of Industry Science and Resources (2024). Critical Minerals List and Strategic Materials List. https://www.industry.gov.au/publications/australias-critical-minerals-list-and-strategic-materials-list. Accessed 5 December 2025.
[14] Australia Department of Industry Science and Resources (2024). Critical Minerals List and Strategic Materials List.
[15] Australia Department of Industry Science and Resources (2024). Critical Minerals List and Strategic Materials List.
[16] See Madden, C. and Laing, K. (2025), Critical minerals. Parliamentary Library Policy Briefs 2025–26, aph.gov.au. https://www.aph.gov.au/About_Parliament/Parliamentary_departments/Parliamentary_Library/Research/Policy_Briefs/2025-26/Criticalminerals. Accessed 7 December 2025.
[17] Deberdt et. al. (2025).
[18] Deberdt et. al. (2025). Smith et. al. (2025).

legal instruments utilized which range from statutes and legislations to executive orders addressing different aspects of interest affiliated to critical minerals.[19] These aspects can range from critical minerals definitions to address supply chain disruptions through different courses of action like reducing reliance on a particular supplier state. For instance an executive order emerging from Department of Interior (EO 13817) defines critical minerals as a *"nonfuel mineral or mineral material essential to U.S. economic and national security, has a supply chain vulnerable to disruption, and serves an essential function in product manufacturing and the absence of this commodity would have significant economic and national security consequences."* [20] Interestingly, the Energy Act of 2020 also defines critical minerals as well as critical materials. Herein, critical materials are identified by the Secretary of Energy and encompass any non-fuel mineral, element, substance, or material that faces a high risk of supply chain disruption and performs an essential function in energy technologies, or is otherwise designated as a critical mineral.[21] In contrast, designating critical minerals is a mandate with the Secretary of the Interior. Critical Materials in this context are identified under what seems to be a resource-management framework and refers specifically to "minerals, elements, substances, or materials deemed strategically important" to the US. Their scope is narrower, explicitly excluding "fuel minerals, water, ice, snow, and common construction materials". In other words, and in terms of application with respect to the US domestic law and policy regime, while all critical minerals may qualify as critical materials, not all critical materials fall within the category of critical minerals.

China

China is a major player in the critical minerals value chain and has, since the 1960s, been prioritized mineral extraction, processing and subsequent downstream segments through state driven industrial policy making.[22] Rare earths in particular have been a specific focus of state initiatives since the 1990s with their identification as "national protective exploitation minerals" and later as "strategic" along with rare earth by products in the National Mineral Resource (2016-2020).[23] The plan also calls for the setting up of early warning systems as well as mineral detection systems to assist domestic industry.

The Chinese policy regime on critical minerals according to literature showcases some interesting features. The first aspect of interest is a policy maker and expert driven approach (as opposed to markets) in guiding the planning segments for the sector.[24] These attempts are a clear marker of state involvement from the planning stage which further extend towards regulating production and exports by setting up quotas. The second aspect of interest is the

[19] US's Energy Act of 2020. https://www.directives.doe.gov/ipt_members_area/doe-o-436-1-departmental-sustainability-ipt/background-documents/energy-act-of-2020. Accessed 7 December 2025; see also Executive Order 13817 of 2017. https://www.federalregister.gov/documents/2017/12/26/2017-27899/a-federal-strategy-to-ensure-secure-and-reliable-supplies-of-critical-minerals. Accessed 7 December 2025; see also Chapman, B. (2025).

[20] US Executive Order No 13817 of 8 December 2017

[21] See US Energy Act of 2020; See also Nassar, N. T., & Fortier, S. M. (2021). Methodology and technical input for the 2021 review and revision of the US Critical Minerals List (No. 2021-1045). https://pubs.usgs.gov/of/2021/1045/ofr20211045.pdf. Accessed 5 December 2025.

[22] See Zhou et. al. (2025); see also Andersson, P. S. (2020); see also Zhou, W. (2024) Why China's critical mineral strategy goes beyond geopolitics.https://www.weforum.org/stories/2024/11/china-critical-mineral-strategy-beyond-geopolitics/. Accessed 6 December 2025

[23] Shen et al. (2020), p 142.

[24] See Zhou, W. (2024) China's critical mineral strategy is about more than just geopolitics. World Economic Forum, https://www.weforum.org/stories/2024/11/china-critical-mineral-strategy-beyond-geopolitics/, accessed March 30, 2026.

Chinese understanding on critical minerals and the role their policy plays in strategically utilising their role in value chains generates to their advantage. A pertinent example of legal interest is how Chinese rare earth export quotas have been subject to formal disputes at the WTO in the past.[25] In a bilateral context, China has strategically utilised rare earth restrictions during bilateral tension. Pertinent instances include the Senkaku/Diaoyu Islands dispute, as well as tensions involving Lithuania and Australia.[26] Recent controls on gallium and germanium similarly illustrate China's willingness and capability to respond to external pressures, in this case US semiconductor-related restrictions.[27]

In terms of the genesis of the term in the Chinese context, Anderson presents an interesting genealogical picture. He points towards how the initial references in the 50s to the term strategic minerals in the context of resource geopolitics between the US and the USSR, wherein both states had been attempting to control resources in other states in concurrence with their respective spheres of influence.[28] Thus, it must be noted that the initial non-legal discussion on the term in China seems to be centred around external developments. Subsequently, Chinese law and policy regime shift focus towards domestic mineral resources, and particularly on illegal mining and industrial policies to boost mineral extraction.[29] Towards the closing of the twentieth century and early twenty first century, Chinese policy pivots towards improving allocation and production capabilities.[30] China witnesses multi - directional growth in this phase and secures its position as a key resource endowed state with a: bustling extractive industry sector; and dominant position in the mineral processing, as well as, select downstream sectors.[31] The growth allowed the Chinese understanding of strategic minerals to be framed widely. This wide framing is in contrast with positions adopted by other states in the world, as most definitions rely on addressing supply chain disruptions or assisting own or allied states' economic growth. Chinese positions to accommodate these prominently used definitions in the world but also go beyond these articulations. In addition, the Chinese understanding appears to subdivide minerals, at the academic level, and in some cases at the policy level. These sub-categories include minerals which China needs (Staple Minerals), minerals required by China's emerging industries (Strategic and Emerging Industry Minerals), and minerals where China has domestic abundance and therefore a strategic advantage (Advantageous Strategic Minerals, *protected minerals*, *pillar minerals*), particularly for defence, aerospace, and other relevant economic sectors.[32]

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[25] Appellate Body Report, China – Measures Related to the Exportation of Various Raw Materials, WT/DS394/AB/R, WT/DS395/AB/R, WT/DS398/AB/R, adopted 22 February 2012, DSR 2012:VII, p. 3295; Appellate Body Report, China – Measures Related to the Exportation of Rare Earths, Tungsten and Molybdenum, WT/DS431/AB/R, WT/DS432/AB/R, WT/DS433/AB/R, adopted 29 August 2014, DSR 2014:IV, p. 1127.

[26] See Brakman, S. et al., Revisiting the China–Japan Rare Earths dispute of 2010 (2023). CEPR VoxEU. https://cepr.org/voxeu/columns/revisiting-china-japan-rare-earths-dispute-2010. Accessed 23 November 2025; Wilson, J. (2022). The Australia-China trade dispute: what happened, and what's next?. Freshfields Risk & Compliance. https://riskandcompliance.freshfields.com/post/102hgbx/the-australia-china-trade-dispute-what-happened-and-whats-next. Accessed 23 November 2025; Cutter, W. and Wester, S. (2024) Resilience & Resolve: Lessons from Lithuania's Experience with Chinese Economic Coercion. Asia Society Policy Institute, https://asiasociety.org/policy-institute/resilience-resolve-lessons-lithuanias-experience-chinese-economic-coercion, accessed March 30, 2026.

[27] See Stimson Center (2025). China's germanium and gallium export restrictions: Consequences for the United States. https://www.stimson.org/2025/chinas-germanium-and-gallium-export-restrictions-consequences-for-the-united-states/. Accessed 24 November 2025

[28] Andersson, P. S. (2020), p 131-133.

[29] Crochet, V. and Zhou, W. (2024), p 260-261

[30] Crochet, V. and Zhou, W. (2024), p 261

[31] Andersson, P. S. (2020), p 131-133.

[32] Andersson, P. S. (2020), p 132-133

The relevance of the Chinese definitions lies in their ability to take into account supply, demand, and strategic considerations. The wide scope and coverage fosters a conducive engagement at the international level while also articulating domestic interests and requirements accurately. Thus domestic recognition of these concepts provides a foundation around which state consent and action can be developed internationally. It also allows a state to seek convergence for definitional purposes with other states.

Japan

Japan represents one of the most active economies in Asia in the context of critical minerals value chains. In terms of identifying minerals as critical, the process in Japan involves an identification of a list of minerals relevant for the Japanese Economy in 1984.[33] Interestingly a diplomatic/political incident surrounding the sovereignty over Senkaku/Daiouyu Islands led to Japan facing a major crisis on account of its dependence on China (up to 90 per cent) in the domain of rare earths.[34] Facing this resource supply crisis, the Japanese authorities revamped its state assisted framework to reorient access to the rare earths sector.[35] The most prominent act in this process was the empowering of the Japan Organization for Metals and Energy Security (JOGMEC) as an incorporated state entity engaged in the exercise of securing Japanese critical minerals supply chains.[36] A list of 31 critical minerals followed, articulating Japanese needs and requirements with JOGMEC was serving at the helm for financial and technical aspects.[37] The list is external in orientation in terms of getting access to mines in other states (starting from Australia and then moving on to others) on account of Japan's resource scarcity.[38] Another area that Japan has extensively focused on in its approach is recycling, wherein it has accounted for recyclability as a factor in identifying relevant minerals as well as projects in international partnerships.[39]

South Korea

South Korea's position is similar to Japan in terms of low resource endowment. This implies a heavy reliance on mineral imports as raw materials for South Korea's export-oriented economy.[40] The economy also displays a high dependence on energy imports. Critical minerals in this context are essential for South Korea's automobile and semiconductor industries as well as its renewable energy goals.[41] Government reports have been particularly cognisant of recent

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[33] See Nakano J. (2021). The geopolitics of critical minerals supply chains. Center for Strategic and International Studies. https://www.jstor.org/stable/resrep30033. Accessed 5 December 2025

[34] Nakano J. (2021). The geopolitics of critical minerals supply chains

[35] Nakano J. (2021); see also Hatayama, H., Tahara, K. (2015).

[36] See Japan Organization for Metals and Energy Security, Overview. https://www.jogmec.go.jp/english/about/about001.html. Accessed 21 November 2025; Kunitomo, H., Japan's metal mining policy and the role of JOGMEC (2005). https://mric.jogmec.go.jp/public/kouenkai/2005-05/JOGMEC_Kunitomo2.pdf. Accessed 21 November 2025

[37] Bown, C. (2024). How the US–Japan Critical Minerals Partnership is a long-overdue step toward real supply chain security. Center on Global Energy Policy Columbia University. https://www.energypolicy.columbia.edu/how-the-us-japan-critical-minerals-partnership-is-a-long-overdue-step-toward-real-supply-chain-security/. Accessed 23 November 2025

[38] Bown, C. (2024). How the US–Japan Critical Minerals Partnership is a long-overdue step toward real supply chain security; see also Nakano J (2021). The geopolitics of critical minerals supply chains, p 21.

[39] Bown, C. (2024). How the US–Japan Critical Minerals Partnership is a long-overdue step toward real supply chain security; see also Nakano J (2021). The geopolitics of critical minerals supply chains, p 21.

[40] Deberdt, R. and Park, H. (2025)

[41] Deberdt, R. and Park, H. (2025)

developments where Korean firms such as Samsung and SK Hynix became collateral damage to United States China semiconductor tensions and suffered financial setbacks.[42] The resource dependence on China, coupled with strong relations with the United States, places South Korea in a difficult position, as prioritising minerals where there is dependence on China may compromise important technology segments and investments linked to the United States.[43]

In this regard, South Korea, particularly its Ministry of Trade, Industry and Energy (MOTIE), adopted a prioritisation approach in 2023. This involved listing 33 critical minerals and creating a separate category of 10 priority minerals from within that list.[44] The focus allows for versatility: reducing dependence on single sources including China, promoting diversification to other foreign partners, enhancing recyclability, and simultaneously prioritising energy security and resource needs.[45] This indicates a flexible and pragmatic approach that accounts for South Korea's short term and long term needs while also providing adequate space to navigate future international developments, including the possibility of a shared definition.

India

The Indian approach was developed by the Ministry of Mines which initiated a three step process.[46] Step 1 analysed the critical minerals definitions and lists of other major economies namely: Australia, Japan, US, Canada, UK and South Korea which led to a narrowing down of 69 elements.[47] Step 2 involved inter ministerial consultations to identify what different parts of the government, particularly those focusing on energy, natural resources and technology had to say on national requirements and shortages.[48] Step 3 saw the adoption of the EU model on empirical aspects of criticality wherein India relied on the economic importance and supply risk variables to come up with a final list of 30 critical minerals.[49] India also amended its Mines and Mineral (Development and Regulation) Act to insert a list of 24 critical minerals in the first schedule.[50]

The fascinating aspect of the Indian approach is its cognisance of, and alignment with, the approaches adopted by different states. India has also conducted joint studies in the past with

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[42] Lee, J. and Yang, H. Shares of Samsung, SK Hynix drop after US makes it harder to produce chips in China. Reuters (2025). https://www.reuters.com/world/china/shares-samsung-sk-hynix-drop-after-us-makes-it-harder-produce-chips-china-2025-09-01/. Accessed 24 November 2025; Samsung Electronics, SK Hynix lose US waiver on chip equipment for China operations. KED Global (2025). https://www.kedglobal.com/korean-chipmakers/newsView/ked202508310003. Accessed 24 November 2025

[43] Kim, D., From dependence to partnership: Korea's quest for supply chain stability in critical mineral resources. Korea Institute for Industrial Economics and Trade (2024). https://www.kiet.re.kr/en/pub/economyDetailView?detail_no=2902. Accessed 27 November 2025

[44] Kim, D., From dependence to partnership: Korea's quest for supply chain stability in critical mineral resources.

[45] Kim, D., From dependence to partnership: Korea's quest for supply chain stability in critical mineral resources.

[46] Press Information Bureau (2023), Thirty Critical Minerals List Released. https://www.pib.gov.in/PressReleasePage.aspx?PRID=1942027&reg=3&lang=2. Accessed 27 November 2025; See also Ministry of Mines (2023), Report of the Committee on Identification of Critical Minerals for India. https://mines.gov.in/admin/download/649d4212cceb01688027666.pdf. Accessed 27 November 2025

[47] Press Information Bureau (2023), Thirty Critical Minerals List Released.; See also Ministry of Mines (2023), Report of the Committee on Identification of Critical Minerals for India.

[48] Press Information Bureau (2023), Thirty Critical Minerals List Released.; See also Ministry of Mines (2023), Report of the Committee on Identification of Critical Minerals for India.

[49] Press Information Bureau (2023), Thirty Critical Minerals List Released.; See also Ministry of Mines (2023), Report of the Committee on Identification of Critical Minerals for India.

[50] See The Mines & Minerals (Development and Regulation) Amendment Act, 2023. https://mines.gov.in/admin/download/64dc579c4f9e31692161948.pdf. Accessed 28 November 2025

states such as Australia to better understand the sector.[51] The Indian approach has its pros and cons. For instance, India's acknowledgment and utilisation of external approaches within the domestic framework may be counterproductive if they do not adequately account for domestic realities. But at the same time this approach can be beneficial in building partnerships externally.

Indonesia

Indonesia is a resource-endowed state that is focusing on expanding downstream capacities in order to boost exports, maintain important reserves, and support economic growth.[52] Its efforts toward designating certain mineral resources as critical are primarily handled by the Ministry of Energy and Mineral Resources (ESDM). There are also several presidential decrees that have had significant implications for critical minerals. Of particular relevance is Ministerial Decree No. 296.K/MB.01/MEM.B/2023 (issued September 14, 2023), which designates 47 minerals as critical.[53] The criteria adopted include relevance for defence, the national economy, and strategic industries, as well as vulnerability to supply risks.[54]

Another Decree 69.K/MB.01/MEM.B/2024 is similarly relevant.[55] It classifies 22 minerals as strategic, subject to periodic review.[56] The focus of the decree and the criteria it prioritises supports minerals important to Indonesia's domestic economy by aiming to expand Indonesia's current status as a resource-endowed state towards downstream economic operations in relevant value chains.[57] The criteria thus factors in relevance for domestic strategic industries, contribution to economic development and foreign exchange reserves, and support for value addition, refining, and processing industries downstream.[58] This aligns with Indonesia's broader approach of restricting the export of raw ores in order to promote domestic value addition. However, domestic value addition can discriminate against for foreign players *inter* alia and as

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[51] See Deloitte / Austrade (2021) Report on Unlocking Australia-India Critical Minerals Partnership Potential. https://www.austrade.gov.au/content/dam/austrade-assets/global/wip/austrade/documents/Unlocking-Australia-India-critical-minerals-partnership-potential.pdf. Accessed 7 December 2025

[52] See Sasongko et al. (2024)

[53]Keputusan Menteri Energi dan Sumber Daya Mineral No. 296.K/MB.01/MEM.B/2023 tentang Penetapan Jenis Komoditas yang Tergolong dalam Klasifikasi Mineral Kritis (2023). https://jdih.esdm.go.id/common/dokumen-external/Kepmen%20ESDM%20No%20296K_MB_01_MEM_B_2023.pdf. Accessed 20 November 2025; See also See Also Ekonomi, A.K.D. (2024) 22 Mineral Strategis Ditetapkan: Poin Penting Implikasi Hilirisasi Mineral. https://kadin.id/analisa/22-mineral-strategis-ditetapkan-poin-penting-implikasi-hilirisasi-mineral/. Accessed 6 December 2025

[54] Keputusan Menteri Energi dan Sumber Daya Mineral No. 296.K/MB.01/MEM.B/2023 tentang Penetapan Jenis Komoditas yang Tergolong dalam Klasifikasi Mineral Kritis (2023). https://jdih.esdm.go.id/common/dokumen-external/Kepmen%20ESDM%20No%20296K_MB_01_MEM_B_2023.pdf. Accessed 20 November 2025; See also See Also Ekonomi, A.K.D. (2024) 22 Mineral Strategis Ditetapkan: Poin Penting Implikasi Hilirisasi Mineral. https://kadin.id/analisa/22-mineral-strategis-ditetapkan-poin-penting-implikasi-hilirisasi-mineral/. Accessed 6 December 2025

[55] Keputusan Menteri Energi dan Sumber Daya Mineral Republik Indonesia nomor 69.K/MB.01/MEM.B/2024 tentang Penetapan Jenis Komoditas yang Tergolong dalam Klasifikasi Mineral Strategis (2024). https://jdih.esdm.go.id/common/dokumen-external/Kepmen%20ESDM%20No%2069K_MB_01_MEM_B_2024.pdf. Accessed 7 December 2025

[56] Keputusan Menteri Energi dan Sumber Daya Mineral No. 69.K/MB.01/MEM.B/2024 tentang Penetapan Jenis Komoditas yang Tergolong dalam Klasifikasi Mineral Strategis (2024). https://jdih.esdm.go.id/dokumen/download?id=2024abskmesdm69k.pdf. Accessed 7 December 2025

[57] Keputusan Menteri Energi dan Sumber Daya Mineral No. 69.K/MB.01/MEM.B/2024 tentang Penetapan Jenis Komoditas yang Tergolong dalam Klasifikasi Mineral Strategis (2024).

[58] Keputusan Menteri Energi dan Sumber Daya Mineral No. 69.K/MB.01/MEM.B/2024 tentang Penetapan Jenis Komoditas yang Tergolong dalam Klasifikasi Mineral Strategis (2024).

a result these domestic value addition measures were challenged by the EU at the WTO, where they were found to be inconsistent with Indonesia's WTO obligations.[59]

Malaysia

Malaysia has identified five strategic minerals including metallic and non-metallic rare earth elements. The focus of this approach in terms of its domestic practice is to aid industries of the 'future' which includes EVs and emerging technology segments. The Malaysian approach aligns with Indonesia in terms of seeking domestic value addition and economic growth but has not yet exhibited discriminatory elements that attract WTO disputes. The Malaysian approach in this context is relevant on account of being more focused on economic and industrial growth as opposed to securing domestic consumption needs.[60] As a result, the Malaysian approach focusses on governance and legislation, apart from mineral resource mapping and inventory.

Vietnam

Vietnam has exhibited the world's second-largest rare earth reserves and produces many minerals that fall in the critical/strategic minerals list for other states.[61] In order to address this segment of their economy better, Vietnam recently overhauled its mining framework by consolidating the mining and geology segments of the government into a single entity through the 2024 Law on Geology and minerals.[62] The law also provides a classification of minerals in terms of priority wherein rare earths feature in Group I[63] category and recognised as a strategic resource. Strategic resources within this law have been defined as "geological resources whose geographic location yields strategic economic, national defence, security, or environmental benefits." Article 6 of the law also provides for a classification where in Group I includes metal minerals; energy minerals, precious stones, semi-precious stones; industrial minerals.[64]
Vietnam's approach merits consideration in terms of its definition firstly, as it merges geological aspects with mining in its legislation. This brings in the technical expertise relevant in areas such as mapping within the economic utilisation of natural resources through mining. Secondly, as a resource endowed state, Vietnam's definitional approach is catering towards multiple end uses and it labels all of those end uses whether environmental, economic or national defence related within the remit of a legal definition.

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[59] Panel Report, Indonesia – Measures Relating to Raw Materials. WT/DS592/R WTO (2022). https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/WT/DS/592R.pdf&Open=True. Accessed 4 December 2025

[60] National Mineral Industry Transformation Plan 2021-2030 (2025), International Energy Agency. https://www.iea.org/policies/16794-national-mineral-industry-transformation-plan-2021-2030. Accessed 3 December 2025

[61] Ji Won Moon, The Mineral Industry of Vietnam in 2022, US Geological Survey Minerals Yearbook (2022). https://pubs.usgs.gov/myb/vol3/2022/myb3-2022-vietnam.pdf. Accessed 7 December 2025

[62] See National Assembly of Vietnam (2024) Law on Geology and Minerals, No. 54/2024/QH15. Socialist Republic of Vietnam

[63] See WTO Chairs Programme (2025), Trading What Matters: Critical Minerals as a New Engine of Growth for Vietnam. https://wcp.ftu.edu.vn/en/research/trading-what-matters-critical-minerals-as-a-new-engine-of-growth-for-vietnam/.Accessed 6 December 2025; See also Vietnamnet (2024), Vietnam proposes rare earths as a special strategic resource. https://vietnamnet.vn/en/vietnam-proposes-rare-earths-as-a-special-strategic-resource-2459260.html. Accessed 6 December 2025.

[64] WTO Chairs Programme (2025), Trading What Matters: Critical Minerals as a New Engine of Growth for Vietnam.

Other Resource endowed states lacking formal-legal definitions

It is pertinent to mention Thailand and Philippines on account of their resource endowments but it is also relevant to note that they do not seem to indicate any specific identification of critical or strategic minerals.[65] Laos, Cambodia and Myanmar follow a similar trajectory with extensive resource endowments but a lack of a formal domestic definition. In addition, Thailand has positioned itself as an effective alternative to Chinese processing industries, with firms specializing in early downstream processing and recycling placed in Thailand.

Looking for convergence in terms of lists

The following is compilation of minerals for the states discussed in terms of their respective domestic definitions and criteria:

Country	Critical / Strategic Minerals Identified
Australia	Antimony, Arsenic, Beryllium, Bismuth, Chromium, Cobalt, Fluorine, Gallium, Germanium, Graphite, Hafnium, High-purity alumina, Indium, Lithium, Magnesium, Manganese, Molybdenum, Nickel, Niobium, PGE, REE, Rhenium, Scandium, Selenium, Silicon, Tantalum, Tellurium, Titanium, Tungsten, Vanadium, Zirconium
India	Antimony, Beryllium, Bismuth, Cadmium, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Nickel, Niobium, PGE, Phosphorus, Potash, REE, Rhenium, Selenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium
China	Aluminum, Antimony, Chromium, Cobalt, Copper, Gold, Graphite, Iron, Lithium, Molybdenum, Nickel, Phosphorus, Potash, REE, Tin, Tungsten, Zirconium *(plus non-metallics: fluorite/fluorspar; and energy minerals: coal, gas, oil, shale gas, uranium)*
Malaysia	Non-radioactive REE (Pr, Nd, Dy), Bauxite/Aluminium, Tin ore, Silica sand, Kaolin
Indonesia	Aluminum/Bauxite, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Cesium, Chromium/Chromite, Cobalt, Copper, Dysprosium, Europium, Fluorspar, Gallium, Germanium, Gold, Graphite, Hafnium, Indium, Iron, Lanthanum, Lithium, Magnesium, Manganese, Molybdenum, Neodymium, Nickel, Niobium, Phosphate/Phosphor, Potassium chloride, Praseodymium, REE, Rhenium, Scandium, Selenium, Silicon, Silver, Strontium, Tantalum, Tellurium, Terbium, Tin, Titanium, Tungsten, Vanadium, Yttrium, Zirconium, Zinc, Platinum, Silica/Quartz sand
Japan	Bismuth, Boron, Cobalt, Graphite, Nickel, Phosphate rock, Phosphorus *(plus priority emphasis on: REE, lithium, tungsten)*

[65] See Aroon, et al. Policies and strategies in sustainable development of mineral resources in Thailand, Review of Policies, Strategies and Activities in Sustainable Development of Land and Mineral Resources in Asia and the Pacific, p 563. https://repository.unescap.org/server/api/core/bitstreams/a275fc36-21f2-427a-9459-eda7ef271b95/content#page=583. Accessed 5 December 2025

South Korea	Aluminum, Antimony, Bismuth, Chromium, Cobalt, Copper, Dysprosium, Gallium, Graphite, Indium, Lanthanum, Lead, Lithium, Magnesium, Manganese, Molybdenum, Neodymium, Nickel, Niobium, Palladium (PGM), Platinum (PGM), Selenium, Silicon, Strontium, Tantalum, Terbium, Tin, Titanium, Tungsten, Vanadium, Zinc, Zirconium
Vietnam	Alumina, Antimony, Manganese, REE, Tin, Titanium, Tungsten, Zinc

From an analysis of the minerals stated in the respective lists of the above mentioned states, it seems that there is a high convergence (features in 4 or above state lists) on at least some minerals, while for others convergences can be graded to lower but still relevant levels. The first set of high convergence minerals include cobalt, graphite, lithium, nickel, tungsten, tin, titanium, zirconium, rare earth elements (including key light and heavy REEs), and molybdenum. These minerals appear across nearly all national lists of the states examined. In terms of relevance, this reflects a convergence of respective economic or strategic demand for these minerals in terms of their utility in clean energy (batteries, renewable energy applications), emerging technology (semiconductors, AI, quantum computing inter alia) as well as the defence sector.

A second cluster of minerals includes gallium, germanium, antimony, chromium, tantalum, vanadium, silicon, selenium, hafnium, and indium. This cluster shows significant convergence and shows similar utility in emerging technology, renewable energy and defence segments. Despite this overlap, it is also pertinent to mention distinct priorities shaped by domestic endowments, requirements, economic goals and industrial strategies. For instance, Malaysia emphasises non-radioactive REEs and bauxite; Japan prioritises minerals linked to acute import dependence as well as recyclability; Indonesia incorporates a wide range of minerals that can be developed into downstream processing capabilities; and China, amongst other factors, includes minerals aligned with its dominant processing position. Apart from this there are some more minerals with a moderate range of convergence in terms of inclusion in national lists i.e. at least 3 states from the analysed lists. These are also significant but may not be prioritised uniformly across the region.

The convergence serves to indicate possibilities of narrowing down on certain minerals for the purposes of an effective internationalisation at a regional or multilateral level. It is also relevant to understand that in the Asian context there is a prevalence of both resource rich, resource deficient but notable economies in the supply chain, and in some instances states that are relevant further downstream along technological verticals. There are also states like China which feature across the supply chain in extraction, processing and downstream segments.

It is also pertinent to note that the strategies/policies adopted indicate both defensive and proactive approaches. The former involves increased attempts to increase the state's role in resource management through various modalities ranging from nationalisation, imposition of export controls, trading only through SOEs or State Monopolies *inter alia.*

A notable aspect when defining critical minerals at an international level is the extent to which domestic criteria may interact with or interfere in the development of an international definition. However, with approaches such as those of India and Australia, where the practices of other states have been taken into account, an international definition appears more like another page from the same book in terms of convergence.

Another aspect concerns the potential non-viability of obligations on critical minerals due to the heavy reliance on national security exceptions in agreements. This may adversely affect substantive obligations, particularly those requiring the free flow of goods across borders, since states may invoke national security to justify restrictions. A further set of problems can be envisaged at the negotiation stage as States may be caught in a paradoxical situation, wherein: deference to national security-based restrictions may hamper the aim of securing supplies and removal of restriction for free flow of goods may conflict with a state's inherent policy space allowing for imposition of trade restrictions in the name of national security.

2. BILATERAL AND PLURILATERAL INITIATIVES: FRIENDS COMING TOGETHER? OR A NECESSITY?

In the previous sections, we have established, that states do not perceive criticality of a raw materials uniformly. In this section, we examine the development of disciplines pertaining to critical raw materials/minerals under various bilateral and plurilateral international instruments. For this task, we first looked at Critical Minerals under Free Trade Agreements, then at the Comprehensive and Progressive deal for Trans-Pacific Partnership (CPTPP) due to several Asian countries being part of the CPTPP, and lastly at the standalone agreements and plurilateral initiatives in the field of critical minerals which do not fit squarely within the established understanding of Free Trade Agreements under the WTO Framework.

2.1 Critical Minerals trade under Free Trade Agreements

A survey of major free trade agreements (FTAs) shows two distinct approaches to commitments on critical minerals. The first approach is the negotiating practice of the European Union (EU) relating to energy and raw materials (ERM).[66] The raw materials in EU's ERM chapters which feature in most of its contemporary FTAs includes minerals under HS Chapters 25 and 26.[67] The EU, in the recent agreements with Chile and Mexico which are yet to enter into force, has concluded dedicated ERM chapters which aim to facilitate trade and investment in the area of raw materials, and improve environmental sustainability in these areas.[68] These chapters include commitments pertaining to raw materials such as:

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[66] See EU – India FTA, Initial Text Proposal by the EU on Energy and Raw Materials (ERM); EU – Australia FTA, Initial Text Proposal by the EU on ERM; EU – Chile FTA, concluded chapter on ERM; EU – Mexico FTA, concluded chapter on ERM; EU – New Zealand FTA, concluded chapter 13 on ERM. https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/negotiations-and-agreements_en. Accessed 15 March 2025

[67] EU – India FTA, Initial Text Proposal by the EU on ERM, Annex I; EU – Australia FTA, Initial Text Proposal by the EU on ERM, Annex I; EU – Chile FTA, Chapter on ERM, Annex I; EU – Mexico FTA, concluded chapter on ERM, Article 2(b); EU – New Zealand FTA, concluded chapter 13 on ERM, Annex 13.

[68] See Chapter 8 - ERM in the EU – Chile Interim Trade Agreement (ITA), available at https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/chile/eu-chile-

a. Prohibiting the designation or maintenance of import and export monopolies[69];
b. Prohibiting dual pricing schemes which impose a higher price for exports[70];
c. Ensuring that grant of authorisation to explore or produce raw materials, where required, follows a public and non-discriminatory procedure[71];
d. Ensuring an assessment of environmental impact prior to granting authorisation for projects or activities relating to raw materials;
e. Cooperation in standard, technical regulation and conformity assessment in raw materials[72]
f. Promotion of research, development and innovation[73]
g. Cooperation on Energy and Raw Materials including reduction/elimination of investment distorting measures, coordination of position in international forum, exchange of market data, promotion of new technology, best practices etc.[74]

The EU's approach is ambitious and entails legally binding obligations that aim to: (a) remove barriers to trade in raw materials; (b) facilitate investment in the exploration and production of raw materials; (c) ensure security of supply and level playing field in the access to raw materials; and (d) improve environmental sustainability. The EU's approach is also distinguished by the listing method adopted by the EU in identifying critical raw materials subject to additional disciplines.[75]

For various Asian countries, many of the provisions usually forming part of the EU's negotiating approach on ERM like the import and export monopolies, dual pricing policies, pre-establishment commitments on non-service investments (i.e., regulatory framework governing authorisation for exploration or production) may be areas of serious sensitivity. These are not only significantly WTO Plus, various Asian countries at present have policies that are directly inconsistent with these obligations.[76] This particularly relates to the maintenance of state support in the form subsidies, operation of state-owned enterprises, industrial policy inter alia.

The second approach has been adopted in Australia's FTAs with Japan and Korea.[77] In the FTA with Japan, Australia has concluded a dedicated chapter on 'Energy and Mineral

agreement/text-agreement_en; see also Chapter 5 - Raw Materials, EU Mexico Modernised Global Agreement (MGA). https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/mexico/eu-mexico-agreement/text-agreement_en. Accessed 17 March 2025

[69] See Article 8.4 of EU Chile ITA and Article 3 of EU Mexico MGA.

[70] See Article 8.5 of EU Chile ITA and Article 4 of EU Mexico MGA.

[71] See Article 8.7 of EU Chile ITA and Article 6 of EU Mexico MGA.

[72] See Article 8.12 of EU Chile ITA and Article 10 of EU Mexico MGA.

[73] See Article 8.13 of EU Chile ITA.

[74] See Article 8.14 of EU Chile ITA and Article 11 of EU Mexico MGA.

[75] See for e.g., EU's initial proposal to the Philippines on ERM in the ongoing FTA negotiations. https://circabc.europa.eu/ui/group/09242a36-a438-40fd-a7af-fe32e36cbd0e/library/f36f79dc-8404-4afc-9f4b-f66a3be33ac7/details. Accessed 15 March 2025

[76] Svetlicinii, A. (2025), p 222-223.

[77] See Chapter 8, Japan – Australia FTA. https://www.dfat.gov.au/sites/default/files/jaepa-chapters-1-to-20.pdf. Accessed 18 March 2025; See also Chapter 16, Korea – Australia FTA.

Resources'.[78] This chapter recognises the importance of strengthening their stable and mutually beneficial relationship in the energy and mineral resources sector.[79] It contains provisions urging Parties to take reasonable measures aimed at ensuring stable supply of energy and mineral resources, and provides a mechanism for consultations to address any severe and sustained disruption to supply of an energy and mineral resource good.[80] This chapter also contains obligations encouraging Parties to not introduce quantitative restrictions on export, and sets out transparency requirements with respect to export licensing procedures and administrations.[81] Importantly, the chapter asks Parties to take into consideration the impact on commercial activities while introducing any regulatory measure of general application pertaining to mineral resources, and ensure that such measures are implemented in an orderly and equitable manner.[82] In this agreement, Australia has followed the listing approach similar to the EU in its chapter on ERM.[83]

In the agreement with Korea, Australia has concluded a chapter on Cooperation which contains a section on energy and mineral resources.[84] This chapter is largely non-binding and aims to provide a mechanism for Parties to cooperate in energy and mineral resource sectors. It envisages information exchange[85], cooperative activities[86], establishment of contact points[87], etc. Similar to the mechanism under the Japan - Australia FTA, it also provides a mechanism for consultations on severe and sustained disruption to supply of a major energy and mineral resources.[88] Australia's agreement with Korea provides a glimpse of a distinct approach followed by the same country.

Aside from the aforementioned approaches, there are other instances wherein mineral resources were subject matter of bilateral commitments at an international level. The EU and Canada, in July 2021, as part of the EU - Canada FTA, issued a joint statement to develop new projects and align financial support for mineral extractions.[89] The EU - Korea Free Trade Agreement (FTA) includes the prohibition of duties, taxes, or other fees on the export of goods, including raw materials.[90] The EU - Singapore FTA includes the prohibition of duties, taxes, or measures of an equivalent effect on the export of raw materials and also the ongoing EU-Vietnam FTA

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https://www.dfat.gov.au/trade/agreements/in-force/kafta/official-documents/Pages/full-text-of-kafta. Accessed 24 March 2025

[78] See Chapter 8, Japan – Australia FTA.
[79] Article 8.1, Japan – Australia FTA.
[80] Article 8.3, Japan – Australia FTA.
[81] Articles 8.4 - 8.5, Japan – Australia FTA.
[82] Article 8.6, Japan – Australia FTA.
[83] Article 8.2(a) and Annex 5, Japan – Australia FTA.
[84] Chapter 16, Korea – Australia FTA.
[85] Article 16.16, Korea – Australia FTA.
[86] Article 16.14, Korea – Australia FTA.
[87] Article 16.18, Korea – Australia FTA.
[88] Article 16.17, Korea – Australia FTA.
[89] Joint Statement by European Commissioner for Internal Market and Canada's Minister of Natural Resources (2021). https://www.canada.ca/en/natural-resources-canada/news/2021/07/joint-statement-by-canadas-minister-of-natural-resources-and-the-european-commissioner-for-internal-market.html. Accessed 24 March 2025
[90] Article 2.11, EU – Korea FTA.

negotiations aim to secure the prohibition of duties or taxes on a number of raw materials, including all critical raw materials.[91]

Further, the EU to develop its industrial ecosystem to cope with the future challenges formed the European Raw Materials Alliance (ERMA) in September 2020 as part of its action plan on 'critical raw materials'.[92] The ERMA contributes to ensuring reliable, secure and sustainable access to raw materials.[93] The alliance aimed to initially focus on the most pressing needs: increasing the EU resilience in the rare earth magnet and motor value chain considered vital to key EU industrial ecosystems, such as automotive, renewable energy, defence and aerospace. ERMA objectives are broadly aimed to be achieved via two major steps (i) value chain specific consultation process; and (ii) investment channel for raw materials projects.[94]

2.2 Mining and Mineral Resources under the Comprehensive and Progressive deal for Trans-Pacific Partnership

Eleven countries in the Asia-Pacific region, including Australia, have signed the Comprehensive and Progressive Trans-Pacific Partnership (CPTPP).[95] To lower trade barriers and facilitate trade, the CPTPP essentially encompasses all trade sectors and facets between Australia and its members.[96]

The CPTPP does not contain a standalone chapter on critical minerals or mineral resources. The agreement, however, eliminates tariffs on key minerals, petroleum and LNG exports and locks them in at zero.[97] The CPTPP also introduces improvements in the regulatory environments for Australian miners and oil and gas companies seeking to find and develop reserves in the region.[98] Australia's cutting-edge suppliers of Mining Equipment, Technologies and Services (METS) and oilfield goods and services also stand to benefit from better market access conditions.[99] CPTPP also resulted in various other significant outcomes, e.g., for Australia regarding exploration, extraction and production opportunities under CPTPP.[100] Additionally, the investment chapter provides for various safeguards including (a) protection action discriminatory treatment[101]; (b) compensation in the event of expropriation[102]; (c) free

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[91] See Internal Market, Industry, Entrepreneurship and SMEs: Trade in Raw Materials. https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/trade-raw-materials_en. Accessed 24 March 2025

[92] European Raw Material Alliance (ERMA). https://erma.eu/about-us/. Accessed 24 March 2025

[93] ERMA.

[94] ERMA.

[95] Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), Department of Foreign Affairs and Trade (DFAT). https://www.dfat.gov.au/trade/agreements/in-force/cptpp/comprehensive-and-progressive-agreement-for-trans-pacific-partnership. Accessed 24 March 2025

[96] CPTPP

[97] CPTPP outcomes: Resources and energy, Australian Government DFTA. https://www.dfat.gov.au/trade/agreements/not-yet-in-force/tpp/Pages/outcomes-resources-and-energy. Accessed 24 March 2025.

[98] CPTPP outcomes: Resources and energy.

[99] CPTPP outcomes: Resources and energy.

[100] CPTPP outcomes: Resources and energy.

[101] Article 9.4, CPTPP.

[102] Article 9.8, CPTPP.

and without delay transfer of investment related capital[103] etc. The investment chapter also contains an investor state dispute settlement (ISDS) mechanism[104] which provides investors access to an independent arbitral tribunal to resolve disputes.

2.3 United States – Japan Agreement on Strengthening Critical Minerals Supply Chains (US Japan CMA)

In 2023, the United States (US) and Japan signed an agreement focused on strengthening and diversifying critical minerals supply chains and promoting the adoption of EV battery technologies.[105] It builds on the US – Japan Trade Agreement of 2019, the US – Japan Partnership on Trade formed in 2021 and the Mineral Security Partnership established in 2022 to facilitate trade, promote fair competition and market-oriented conditions for trade in critical minerals.[106] It also envisages cooperation in the area of critical minerals supply chains.[107] This agreement, while similar, in approach, to the listing approach in EU ERM chapter and the approach adopted in Australia - Japan, is also quite unique due to a standalone agreement in this field.[108] The important obligations contained in the US Japan CMA include:

1. **Facilitation of trade in critical minerals** through affirmation of obligation not to impose quantitative restrictions on the import or export of critical minerals in accordance with Article XI:1 of GATT 1994, and the obligation to accord national treatment to the critical minerals of the other Party in accordance with Article III of GATT 1994.[109] Imposing export duties on critical minerals is also prohibited.[110] Parties are to confer on non-market policies and issues relating to global critical mineral supply chains, including extraction and processing capacity and trends, price differences between markets, domestic industry conditions, and trade flows.[111]

2. **Facilitating Sustainable Supply Chains for Critical Minerals** by intending to establish and maintain procedures for assessing environmental impacts of critical mineral projects and the intention to ensure that their environmental laws and policies provide for high levels of environmental protection with respect to critical minerals.[112]

3. **Building Equitable Supply Chains for Critical Minerals** by intending to adopt and maintain labour rights in their statutes, regulation and practices, as well as the intention

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[103] Article 9.9, CPTPP.
[104] Section B, CPTPP.
[105] See USA Japan Agreement on Strengthening Critical Minerals Supply Chains (US Japan CMA). https://ustr.gov/sites/default/files/2023-03/US%20Japan%20Critical%20Minerals%20Agreement%202023%2003%2028.pdf. Accessed 24 March 2025
[106] Article 1, US Japan CMA.
[107] Article 5.9, US Japan CMA.
[108] Article 2 and Annex, US Japan CMA.
[109] Article 3, US Japan CMA.
[110] Article 3, US Japan CMA.
[111] Article 3, US Japan CMA.
[112] Article 4 , US Japan CMA.

to effectively enforce its labour rights.[113] It also includes a non-derogation provision with respect to labour standards. [114]

4. **Cooperation on Critical Minerals** which includes cooperation both bilaterally and in plurilateral fora regarding efforts to ensure secure, sustainable, and equitable critical minerals supply chains.[115] Parties are to endeavour to refrain from adopting or maintaining any measure that would nullify or impair the objective of this Agreement or otherwise impede the cooperation.[116]

Aside from the core obligations set out above, the agreement also stresses the importance of consulting on trade policy related to critical minerals supply chains with a wide range of stakeholders.[117] It also contains a provision on security exceptions which clarifies that Agreement does not preclude Parties from applying measures that they consider necessary for the fulfilment of obligations pertaining to maintenance or restoration of international peace or security or for the protection of its own essential security interests.[118]

The US had launched discussions for a similar deal with the EU in early March of 2023.[119] The discussions aimed to help the EU and the US build secure supply chains for critical minerals for EV batteries.[120] The proposed agreement would help the EU qualify for tax credit and other subsidies such as those under the US' Inflation Reduction Act which are offered to groups that source minerals and materials from countries which have a free trade agreement with the US.[121] According to recent reports, the agreement between the EU and the US will likely be similar to the US – Japan Agreement on Strengthening Critical Minerals Supply Chains that also included a commitment to not impose restrictions or export duties on cobalt, graphite, lithium, manganese and nickel that are used in electric car batteries.[122] Recently, the US, ahead of the Asia-Pacific Economic Cooperation Summit (APEC), announced three new agreements with Malaysia, Thailand and Japan with a view to strengthen cooperation in the field of Critical Minerals.[123] These agreements are not similar in scope. The MoUs with Thailand and Malaysia are said to be steps towards building a cooperation foundation, whereas the agreements with Japan and Australia are more targeted and focus on capital deployment for strategic projects.[124]

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[113] Article 5, US Japan CMA.
[114] Article 7, US Japan CMA.
[115] Article 7, US Japan CMA.
[116] Article 7, US Japan CMA
[117] Article 6, US Japan CMA.
[118] Article 8, US Japan CMA.
[119] US and EU launch new talks on critical minerals trade in green tech race, Financial Times (2023). https://www.ft.com/content/257f7d0d-cf9d-472b-9c49-e9aafa7977de. Accessed 24 March 2025
[120] US and EU launch new talks on critical minerals trade in green tech race, Financial Times (2023).
[121] US and EU launch new talks on critical minerals trade in green tech race, Financial Times (2023).
[122] US and EU Near Critical Minerals Accord to Unlock US Subsidies, Bloomberg (2023). https://www.bloomberg.com/news/articles/2023-03-29/us-and-eu-near-critical-minerals-accord-to-unlock-us-subsidies#xj4y7vzkg. Accessed 24 March 2025
[123] Schwartz, M., and Baskaran, G., Ahead of APEC, Trump Signs Flurry of Bilateral Minerals Agreements on Asia Tour (2025), Centre for Strategic & International Studies (CSIS). https://www.csis.org/analysis/ahead-apec-trump-signs-flurry-bilateral-minerals-agreements-asia-tour. Accessed 24 March 2025
[124] Schwartz, M., and Baskaran, G., Ahead of APEC, Trump Signs Flurry of Bilateral Minerals Agreements on Asia Tour (2025), CSIS.

2.4 Plurilateral Initiatives for Strengthening trade, investment and supply chain of Critical Minerals

The FTA practice in the Critical Minerals domain is limited. The EU is clearly a pioneer, and Australia, a resource rich country, has also taken the lead in this domain. None of the FTAs examined above has given an objective definition covering aspects of what makes these raw materials critical. The practice, at present, reflects a subjective approach based on mutual interest or as a result of trade-offs of a particular negotiation. Apart from these bilateral endeavours, the plurilateral initiatives in this domain have also witnessed increased participation. In the below paragraphs, we briefly trace three such examples - US led Mineral Security Partnership (MSP), EU led Critical Raw Materials (CRM) Club, and US led Indo-Pacific Framework for Prosperity (IPEF).

MSP

The US led MSP has fourteen partners, with three of them being Asian countries: India, Japan, and Korea.[125] Another four Asian countries are also part of the MSP Forum which has fifteen members. All these countries part of MSP forums are resource rich, endowed with various minerals.[126] MSP is yet another *sui generis* plurilateral partnership that does not even define the "minerals" for which this security partnership exists.[127] However, the goal of MSP is pretty clear and that is to bring together resource rich countries with MSP Partner's "Finance Network" for expansion of investment by MSP partners in resource rich countries.[128] MSP partnership is based on various principles for various projects such as ESG standards, regulatory transparency and cooperation, participatory process for acquisition of land among others.[129] The specific details of how this partnership enables increased investment by MSP are not clear; however, a few press notices seem to reflect that this partnership is steered through various forums such as "EU Raw Materials Week," wherein project proponents and financiers can potentially meet.[130]

EUs Sui Generis Initiatives

The EU's approach to critical minerals also focuses on bringing together like minded states across the supply chain, including resource endowed, processing, and consuming countries. This is envisaged as a holistic approach toward building strategic partnerships that facilitate the EU's resource requirements.[131] The EU Critical Raw Materials Act (CRMA) serves as a trade policy tool in this regard, with the focus on promoting adherence to WTO rules in order to maintain the global nature of supply chains.[132] It also encourages the use of free trade

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[125] U.S. Department of State, Minerals Security Partnership (MSP). https://www.state.gov/minerals-security-partnership. Accessed 29 November 2025

[126] Ministry of Foreign Affairs, Republic of Korea, Joint Press Release on the MSP Principals (2025). https://www.mofa.go.kr/eng/brd/m_5676/view.do?seq=323021. Accessed 29 November 2025.

[127] U.S. Department of State, MSP.

[128] U.S. Department of State, MSP.

[129] U.S. Department of State, MSP Principles for Responsible Critical Mineral Supply Chains (2023). https://www.state.gov/wp-content/uploads/2023/02/MSP-Principles-for-Responsible-Critical-Mineral-Supply-Chains-Accessible.pdf. Accessed 29 November 2025.

[130] European Commission, Commission Hosts MSP, Advance Critical Raw Materials Projects (press release, 2024). https://single-market-economy.ec.europa.eu/news/commission-hosts-minerals-security-partnership-advance-critical-raw-materials-projects-2024-12-12_en. Accessed 29 November 2025.

[131] Crochet, V. and Zhou, W. (2024).

[132] Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024 establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU)

agreements with dedicated provisions under the ERM chapters, investment treaties, and Investment Facilitation Agreements such as SIFA.[133]

As discussed earlier, the ERM chapters are of particular relevance. Article 37 of the CRMA is important in this context. It aims at building diversified and stable supply chains for the EU by allowing EU firms to operate in resource endowed states, while ensuring that these states provide non-discriminatory access and accord commercial considerations to EU firms.[134] In addition, the EU has signed MoUs with multiple states, including Canada (2021), Ukraine (2021), Kazakhstan (2022), Namibia (2022), Argentina (2023), Chile (2023), Zambia (2023), the DRC (2023), and Rwanda (2024). These MoUs underscore strategic partnerships.

Further, the EU is signing MoUs and investment facilitation initiatives such as the Sustainable Investment Facilitation Agreements to streamline the process of investing in partner states through EU firms.[135] SIFA is particularly relevant in its aim to ensure an MFN standard in the treatment of EU firms. It also aims to build policy certainty by promoting obligations that maintain a transparent and predictable regulatory framework.[136] At the same time, it respects the state's right to regulate, while introducing an impact assessment framework for major measures of general application that fall within the Agreement's scope. SIFA also contains obligations requiring the parties to respect their respective MEA commitments to the best of their efforts.[137]

IPEF Pillar II Agreement on Supply Chains

IPEF Pillar II Agreement on Supply Chains is a first-of-its-kind International Agreement specifically dedicated to supply chain resilience. The Agreement aims to create a robust and resilient supply chain network among the 14 IPEF partner countries.[138]

The IPEF Supply Chain Agreement focuses on collaborative[139], and individual actions to strengthen supply chain[140]. These efforts may take the form of collective identification of newer ways to increase the resilience of a particular supply chain, individual efforts in enhancing regulatory transparency and efficiency, facilitating foreign direct investments, focus on skill development, identification of critical sectors and key goods etc.[141]

No 168/2013, (EU) 2018/858, (EU) 2018/1724 and (EU) 2019/1020, OJ 2024 L 125/2. (EU CRM Regulation); See also Blot, E., Sourcing critical raw materials through trade and cooperation frameworks. Institute for European Environmental Policy (IEEP), March 2024, https://ieep.eu/publications/sourcing-critical-raw-materials-through-trade-and-cooperation-frameworks/. Accessed 24 March 2025

[133] See EU CRM Regulation; see also Blot, E., Sourcing critical raw materials through trade and cooperation frameworks. Institute for European Environmental Policy (IEEP).

[134] See EU CRM Regulation; see also Blot, E., Sourcing critical raw materials through trade and cooperation frameworks. Institute for European Environmental Policy (IEEP).

[135] See Sustainable Investment Facilitation Agreement between the European Union and the Republic of Angola, Council Decision (EU) 2024/829 of 4 March 2024 (EU Angola SIFA). https://investmentpolicy.unctad.org/international-investment-agreements/treaty-files/8384/download. Accessed 24 March 2025; See also Andreotti, N. (2024), p 229-245.

[136] See EU Angola SIFA; See also Andreotti, N. (2024), p 229-245.

[137] See EU Angola SIFA; See also Andreotti, N. (2024), p 229-245.

[138] See, Article 1 Definition of IPEF supply chains, Indo-Pacific Economic Framework for Prosperity Agreement relating to Supply Chain Resilience (IPEF Supply Chain Agreement). https://www.mfat.govt.nz/assets/Trade-agreements/IPEF/IPEF-Supply-Chain-Agreement-Text-8-September-2023.pdf. Accessed 13 September 2023.

[139] Article 2, IPEF Supply Chain Agreement.

[140] Article 3, IPEF Supply Chain Agreement.

[141] Articles 2-11, IPEF Supply Chain Agreement.

IPEF members in the first meeting of the Supply Chain Council formed an action plan team for collaboration on semiconductors, critical minerals and chemicals.[142] Additionally, Australia and IPEF members also established an IPEF Critical Minerals Dialogue to strengthen the critical mineral supply chain.[143] The particulars of discussion under these cooperation/focus groups within IPEF remains unknown to the public. Thus, the approach adopted to define critical minerals (if any) remains unknown. That said, such initiatives provide a foundation for further collaboration on issues involving supply chain in general or with a focus on critical minerals. Further such a framework definitely promotes greater regional cooperation. This is also evident in a series of MoUs in this area by and among IPEF members.[144]

ASEAN

ASEAN's relevance in the context of critical minerals emerges on account of multiple factors. These include resource availability, production and processing capacities, and proximity to major economies and leaders across the value chain, spanning resource endowments, processing, and technology segments in states such as Australia, Japan, South Korea, China, and India. ASEAN's FTAs and the RCEP also constitute relevant developments in this regard. Its member states' extensive participation in wider frameworks like the IPEF is also notable.[145]

ASEAN has also been active in certain respects when it comes to critical minerals. This is evidenced by initiatives such as the ASEAN Minerals Development Vision (AMDV) 2045 and the ASEAN Minerals Cooperation Action Plan (AMCAP).[146] ASEAN has the potential to play a much greater role in critical mineral supply chain. ASEAN is a resource rich region with endowment of various minerals generally considered critical, some of these minerals are nickel, bauxite, rare earth elements etc.[147] Another important aspect for consideration is China's dominance in the processing of various critical minerals, and various countries - individually or as a group - attempting to build coalitions to counter China's dominance.[148] AMDV 2045

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[142] Secretary Raimondo, IPEF Ministers Welcome Upcoming Entry into Force of the Clean Economy Agreement, Fair Economy Agreement, and IPEF Agreement, and Commit to Continued Progress at Virtual Ministerial, US Department of Commerce. https://www.commerce.gov/news/press-releases/2024/09/secretary-raimondo-ipef-ministers-welcome-upcoming-entry-force-clean. Accessed 24 March 2026

[143] IPEF, Australian Government DFAT. https://www.dfat.gov.au/trade/organisations/wto-g20-oecd-apec/indo-pacific-economic-framework. Accessed 24 March 2026

[144] See the MoU between India and the USA under India USA Commercial Dialogues. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2062127&reg=3&lang=2. Accessed 24 March 2026; See also MoUs between USA and Thailand. https://www.whitehouse.gov/briefings-statements/2025/10/memorandum-of-understanding-between-the-government-of-the-united-states-of-america-and-the-government-of-the-kingdom-of-thailand-concerning-cooperation-to-diversify-global-critical-minerals-supply-cha/. Accessed 24 March 2026

[145] See Zhao, X. (2025); See also Vivoda et al. (2025).

[146] See ASEAN Minerals Cooperation Action Plan IV (AMCAP IV) 2026–2030. https://asean.org/wp-content/uploads/2025/10/ASEAN-Minerals-Cooperation-Action-Plan-AMCAP-IV-2026-2030-1.pdf. Accessed 15 March 2025; ASEAN Minerals Development Vision (AMDV). https://asean.org/book/asean-minerals-development-vision/. Accessed 15 March 2025; ASEAN Principles for Sustainable Minerals Development (APSMD) (2025). https://asean.org/wp-content/uploads/2025/10/ASEAN-Principles-for-Sustainable-Minerals-Development-APSMD-Brochure-1.pdf. Accessed 15 March 2025

[147] APSMD 2025.

[148] See A Kumar and A Vishwanathan (2025); See also S Kalantzakos (2020).

sets the overarching objectives, while the AMCAP, presently in its fourth rendition, outlines the pathway toward creating an ASEAN region capable of functioning as an effective production and transformation hub for critical minerals.[149] In addition to these documents, ASEAN has promulgated a set of ten principles known as the ASEAN Principles for Sustainable Minerals Development (APSMD), which underscore the ASEAN approach to critical minerals.[150] The APSMD principles reflect multiple undertones, including integration with national frameworks; transparency, monitoring, reporting, and stakeholder engagement; a focus on outcomes and the utilisation of law and policy tools to achieve them; and attention to health, sustainability, cultural considerations, and environmental protection in developing the minerals sector.[151] Various initiatives by ASEAN fails to recognise the supply chain dominance and eventual supply chain security questions related to critical minerals.

3. SHARED FOUNDATION AND KEY DISTINCTION

We have traced significant convergences in the lists of critical minerals maintained by various countries. These convergences are guided by a common goal and strategic interest in transitioning towards a cleaner economy. The distinction in national policies, and identification of critical minerals is also rooted in distinct domestic priority. For example, a resource scarce country might prioritise stock reserves and supply chain security, while a resource rich country might prioritise value addition, economic boost, and job creation. The converges are prominent in critical mineral discussions under FTAs, and various plurilateral initiatives. EU's approach in the ERM chapter of its FTAs brings convergences - probably as balance in the negotiation outcome - in its FTAs with resource rich countries. This is primarily visible in export side obligations, transparent and predictable regulatory procedure. Plurilateral initiatives, on the other hand, acts as a common platform for focussed networking. US led MSP serves as a suitable example in this regard. MSP partners have agreed on common principles, including regulatory transparency and ESG standards, among others. The consensus on broad level principles seem achievable, however, a consensus on a list of critical minerals or critical raw materials seems unlikely. The below table briefly compares approach adopted by ASEAN, and those led by the US and EU.

Parameter	ASEAN	EU led approaches	US led approaches
Type of arrangement	• Plurilateral initiatives through Vision Document, and Action Plans.	• Bilateral through ERM chapter in its FTAs; Sui-generis domestic legislation	• Plurilateral initiatives such as MSP, IPEF, and most recently Critical Minerals Ministerial
Approach adopted	• Focussed Working Groups - Trade and Investment,	• Trade side obligations • Regulatory Transparency	• Supply Chain transparency and predictability • ESG principles

[149] APSMD 2025.
[150] APSMD 2025.
[151] APSMD 2025.

	Sustainable Mineral Development, Information and Data Base. • Periodic Review of previous action plans.	• ESG principles • Standard development cooperation	• Investment focussed
Binding status	• No	• Yes	• No. The individual project as an outcome may have separate contractual obligations.
Membership	• ASEAN Members	• EU's FTA with Chile, Indonesia, Mexico	• Vast network of resource scarce as well as resource rich country. The recent ministerial had delegations from more than 50 countries.
List of Critical Minerals	• No	• Yes, primarily covers HS Chapters 25 and 26.	• No

4. CONCLUSION

The central logic underlying several developments in the critical raw materials/minerals arena is the desire to reduce reliance on a single state and thereby limit vulnerabilities. Despite the issue being rooted in domestic needs, most of the legal or policy tools discussed in the paper demonstrate the resolve of states to engage internationally in different capacities to attain domestic goals for which critical minerals are essential. At the same time, the issue is also embedded in efforts by resource rich and capacity endowed states to preserve, entrench, and expand their space within the minerals value chains. Also, the need to cooperate with a view to diversify and secure the supply chain remains imperative, irrespective of the different positions and objectives.

Given the current fragmented approach to define “criticality” and identification of critical minerals, the world urgently needs a shared definition of what constitutes a critical mineral, or at least common identifiers for what constitutes 'critical'. The 'critical' in critical minerals summarily emanates from domestic priority, supply chain vulnerability, and these issues overall being linked to increased drive towards transition to a cleaner economy. While the domestic priority may differ, there is potential and immense value in developing an international approaches towards defining “critical minerals” or “criticality” at the least. Definitions are not merely attempts to create uniform international standards; they also create

space for contestation shaped by domestic positions. These contestations, discussions, and the developments that follow reveal potential normative possibilities. The normative possibility also covers adoption of uniform criteria to determine "criticality", which is highly desirable for any coordinated action. They may also assist the formulation of substantive obligations and link more effectively with domestic approaches across a range of states that play an important role in critical mineral supply chains. A possible way forward is the approach adopted by IPEF partners in identification of critical sectors or key goods. Various countries are already guided by the need to transition towards a cleaner economy. This has the potential to unite various countries to converge on parameters such as common objective, level of dependence on a single source, constraints on account of geographical factors, and availability and reliability, among others.

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