STRADE

Strategic Dialogue on Sustainable Raw Materials for Europe (STRADE)

Supporting the EU Mineral Sector

Capitalising on EU strengths through an investment promotion strategy

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29 September, 2018

Funded by the
Horizon 2020 Programme
of the European Union

Final draft report

Öko-Institut e.V. · SNL Financial · University of Dundee · projekt consult Member of GFA Consulting Group · GEORANGE · DMT

Project Number: 689364

Project Period: 1.12.2015 – 30.11.2017

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In the 1850s, Europe accounted for more than 50% of global mineral production but this share had fallen to under 5% by 2018. Comparing EU's mineral production in 2010 to its expected production in 2020, only a marginal increase is expected for copper production[1], while production for nickel, zinc and iron ore is expected to stay near the same levels as today.

EU's mineral production is accounted for by a handful of Member States. For example, Poland accounts for 56% of EU's copper production, Sweden accounts for 90% of iron ore production, Greece and Finland each account for near one half of nickel production. Sweden accounts for 43% and Ireland for 32% of EU lead and zinc production respectively.

This production also comes overwhelmingly from single companies in these countries. For example, Poland's copper production is largely accounted for by KGHM and LKAB accounts for most of the iron ore produced in Sweden. For lead and zinc and nickel, the story is similar – with only one or two mining companies accounting for more than half of the production in the EU. This lack of diversity in domestic sourcing, both in terms of geography and in terms of company could be considered a strategic risk by some experts, while others would consider this as an example of specialisation.

Under the EU Raw Materials Initiative (RMI), securing raw material supply from domestic (primary & secondary) and internationals sources, have been set out as clear objectives. Yet, while the price commodity boom of 2003-2008 saw mineral production increase in a number of other regions, EU mineral production has remained at the same levels.

Figure 1 Clustering of EU mining projects (2018)

Source: MiningIntelligence.com

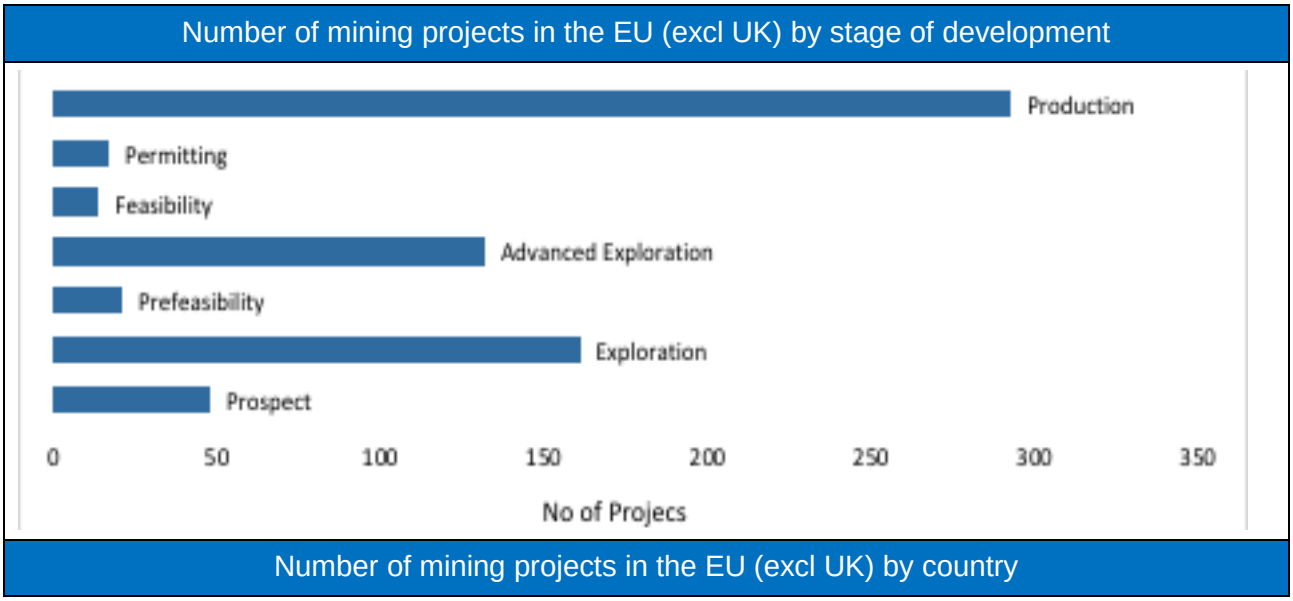
Over the course of the STRADE project, based on a review of academic and trade literature, interviews with mining sector stakeholders, consultations with policy advisors and a review of production and investment data, STRADE has endeavoured to identify the reasons behind the current state of the EU mining sector and develop recommendations to address them.

From purely a mining sector perspective, the abysmal performance in attracting exploration investments over the past decades is cited as one of the major reasons why new production capacity has not been steadily added to the EU. As Figure 2

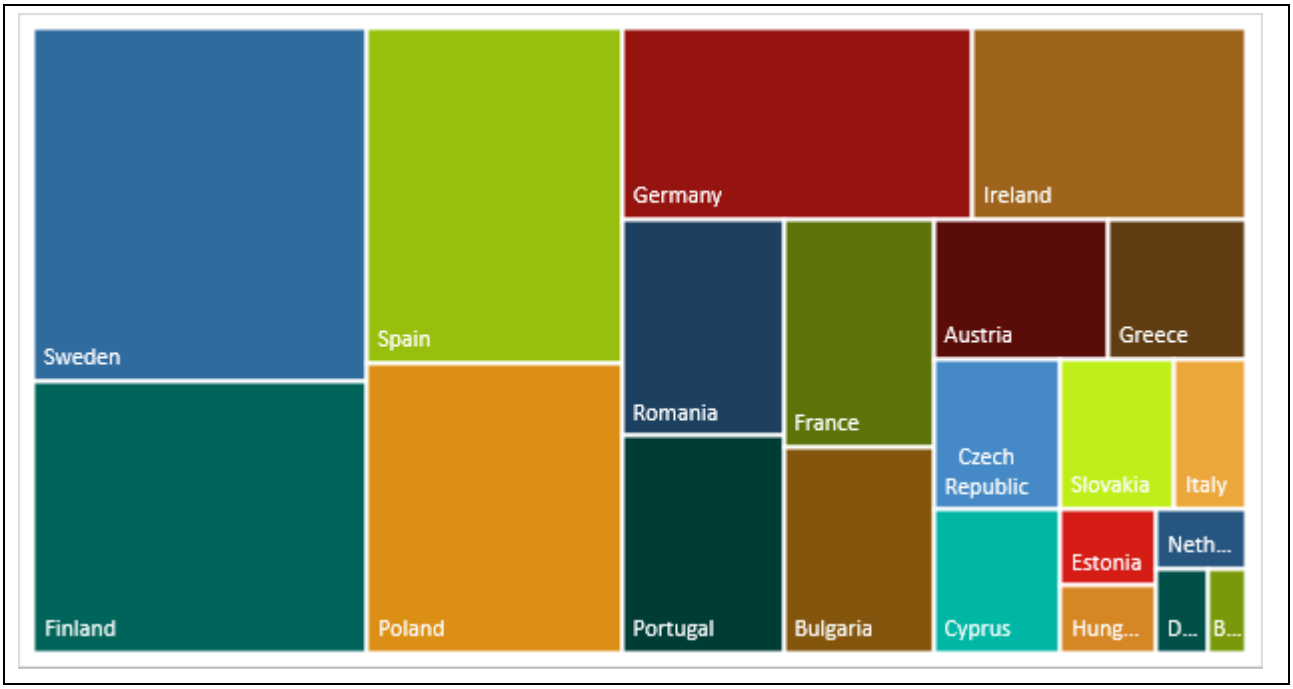
[1] STRADE Report 02/2018 'Promoting Investor Interest in the EU Mining Sector'

indicates, the number of active projects that advance from prospecting to permitting are fairly limited, below 200 for the EU Member States (excluding the UK[2]). What is of more concern is that the number of projects at the advanced exploration stage are near half of those at production – in most countries the norm would be the other way around. A healthy mining sector is pyramid shaped, where the largest number of projects exist at the exploration stage to form the base, progressing steadily through stages of feasibility, narrowing up to smaller number of operating projects at the tip of the pyramid.

Figure 2 EU based (active) exploration & mining operations (2018)



[2] With Brexit approaching in early 2019, it was felt prudent to not include UK based projects in this analysis, as these will no longer be relevant to the domestic EU mineral production discussion in the future.



Source: MiningIntelligence.Com

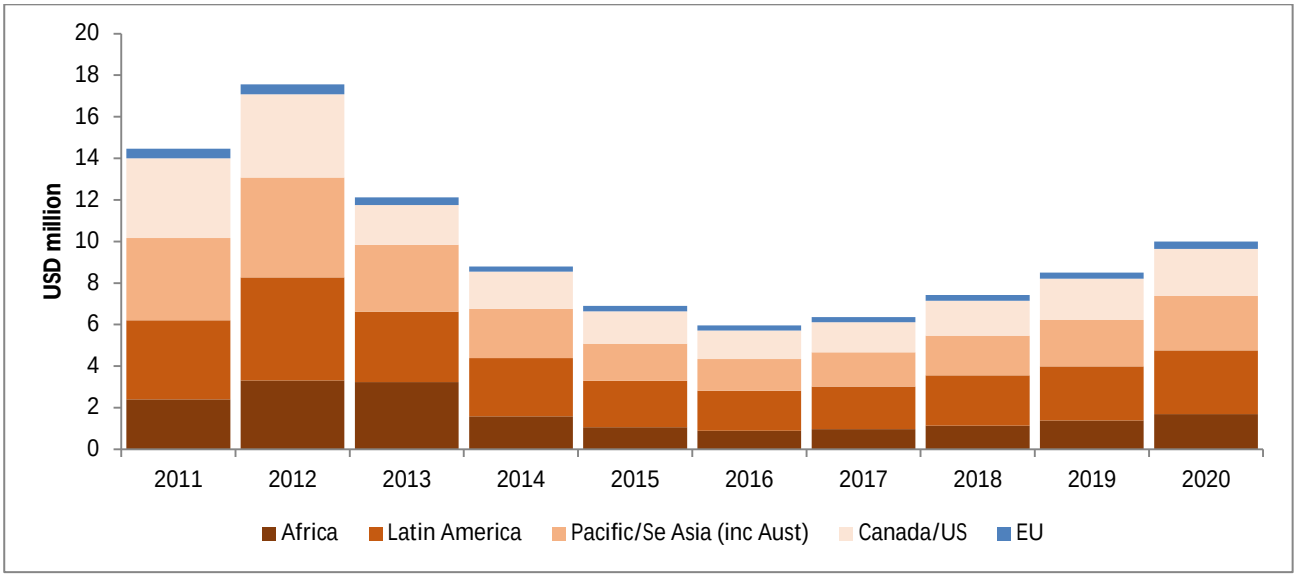
There is also a clear regional tilt for projects by country. Sweden, Finland, Spain, Poland, Germany and Ireland account for nearly 65% of the projects (exploration & operations) active in the EU in 2018, with the rest of the countries accounting for less than 30 projects each.

The full list of minerals and metals covered under this report is provided in Annex 1. Steel statics are not included in the mineral trade and production data in this report. The dynamics and size of the steel sector are different from those of most other base and industrial minerals and would require a different discussion. Within STRADE limitations this was not possible, therefore steel is not discussed in this report.

1.1 The significance of EU exploration expenditure

STRADE's Policy Brief (03/2016) analysed exploration budgets for six commodities (copper, gold, iron ore, lead, nickel and zinc) over a five-year period. For the period 2016-2020, EU exploration is forecasted to grow more cautiously due to the region's relatively small junior sector – a sector which propels exploration during boom periods. Without change to the EU's mining regimes structures, the EU's exploration expenditure is expected to grow at an average of 8% over the period. To put that into context, the EU accounted for 3% of global exploration expenditure in 2017 and the EU's share is not expected to change substantially by 2020.

Figure 3 Exploration expenditures by location (2011-2020)



Source: S&P Global Market Intelligence (2016)

Exploration is the heart of any mining sector, the greater the exploration expenditure, the stronger the supply potential. At the exploration stage, particularly greenfield projects, the geological potential and access to this data are key considerations. On par with geological potential is the legal and regulatory regime of a country. Exploration is mostly conducted by junior companies, and they are likely to invest in jurisdictions where a) they believe there is the potential of identifying an economically viable project and b) where the risk of being unable to transfer their find to a mining company, due to regulations, is low.

The combination of good geological potential, strong regulatory regimes and comparable international competitiveness are the key to promoting the EU Mining Sector.

Many known European deposits have been exploited to great depths, near surface mining having largely been fully exploited. This impacts the geological potential of the region, as future mining activity is likely to involve deep deposit mining, which can often be capital intensive and requires advanced technologies.

On 'geological potential' European Member States are also competing with third countries, including those in Latin America and Africa. The geological potential alone cannot serve as a means of attracting investors[3] in the EU. A mining company, whether an Intermediate or a Major, seeks jurisdictions where the risk of losing the 'right to mine' is minimum and regulatory assurances, which may be stringent and of high standard, are conducive to supporting mining activity. The rights refers to a rules-based system, where a company meeting the legal and regulatory requirements, has the first right to proceed with mining. Jurisdictions that heavily rely on discretionary authority to award this right, increase the risk for investors[4]. Therefore, to address

[3] Only in rare cases, for example the richness of the copper/cobalt deposit in the DRC, the high grade of the geological potential is enough to overcome all other regulatory and social limitations.

[4] For a more detailed discussion on investor perspectives, please see STRADE Policy Brief 05/2017 on Attracting mineral investors: The fundamentals of investor decisions

exploration and in turn increase the number of mining projects, the geological potential attractiveness must be combined with regulatory and non-regulatory standards that can attract exploration and mining companies.

1.2 Current EU support for mining

The EU's raw material policy outlined by the Raw Materials Initiative (RMI) was set out in 2008, largely as a response to the extraordinary increase in global metal prices in the 2003-2008 period. The initiative focused on three pillars to secure raw materials supply – (i) fair and sustainable supply of raw materials from global markets; (ii) Sustainable supply of raw materials from within the EU and; (iii) Resource efficiency and supply of secondary raw materials through recycling.

The EU, through its various instruments and agencies has supported the mining sector and its stakeholders. The European Commission, through the Horizon 2020 call as well as the 7th Framework programme has funded technical, social, policy and governance focused projects on raw materials[5]. The RMI is now being brought into closer alliance with the Commission's priorities for 2015-2019 (see Figure 4).

EU support for the domestic raw materials is expected to actively consider job creation, with a particular emphasis on creating the skill and the knowledge within the younger generation to support the sector in the future. While the employment directly generated by the EU mining sector may be relatively low to other industries, it leads to secondary employment in ancillary industries (such as equipment and services) and can create investment opportunities.

The Strategic Implementation Plan sets out clear objectives for the EU's raw materials strategy:

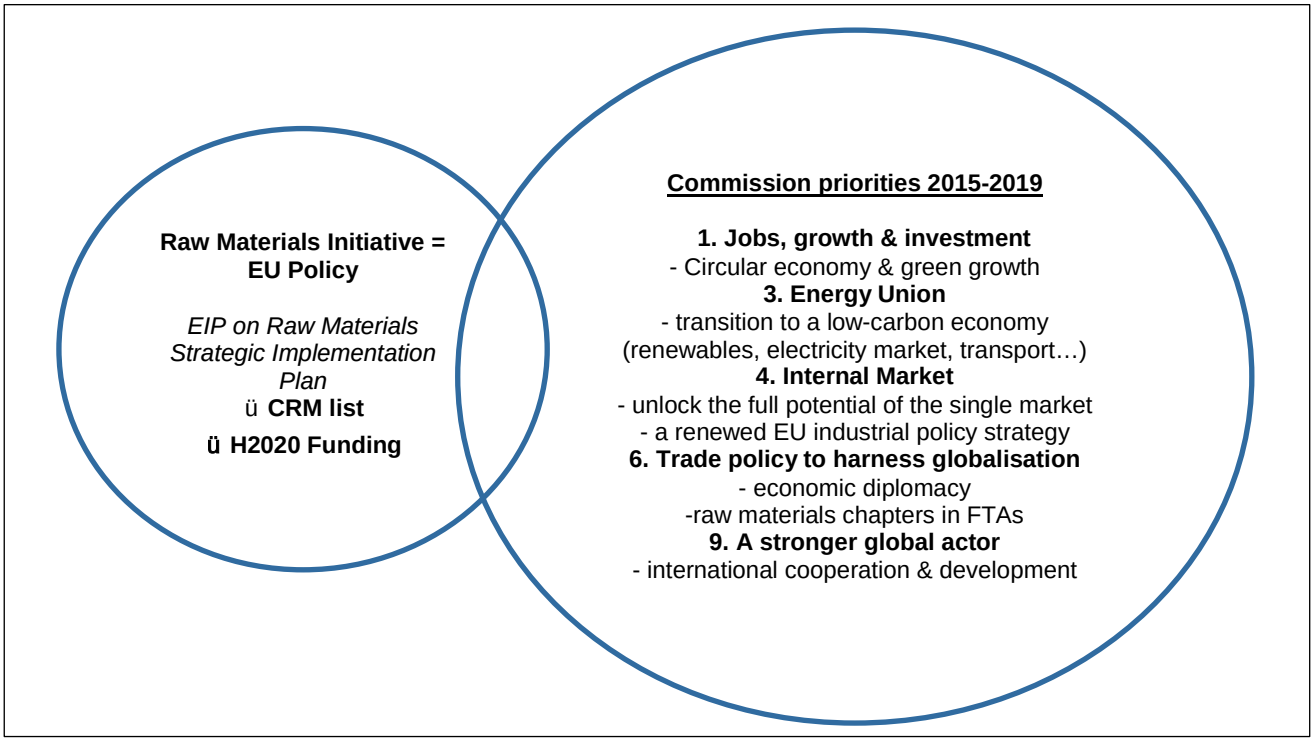
- Reducing import dependency and promoting production and exports by improving supply conditions from EU, diversifying raw materials sourcing and improving resource efficiency (including recycling) and finding alternative raw materials.
- Putting Europe at the forefront in raw materials sectors and mitigating the related negative environmental, social and health impacts.

Of the targets specified under the European Innovation Partnership (EIP) on raw materials, to be achieved by 2020, some of the ones considered relevant to the STRADE project include:

- Up to 10 innovative pilot actions on exploration, mining, processing, and recycling for innovative production of raw materials;
- Framework conditions for primary raw materials that would provide a stable and competitive supply from EU sources and facilitate its public acceptance;
- European raw materials knowledge base with information, flows and dynamic modelling system for primary and secondary raw materials;
- Network of Research, Education and Training Centres on sustainable raw materials management organised as a Knowledge and Innovation Community;
- Pro-active international co-operation strategy of the EU at bilateral and multilateral level, promoting synergies with countries such as the US, Japan, Australia, Canada, Latin America and African Union across the different areas covered by the EIP.

[5] For a full list and summary of these programmes please visit here.

Figure 4 EU Raw materials strategy in the context of wider EC priorities



Source: Milan Grohol (DG Grow) presentation at Cluster event for ongoing Horizon 2020 funded projects – EASME (5, June 2018, Brussels)

The EU's approach as reflected by the RMI, EIP and SIP tend to indicate a fundamental understanding of what needs to be achieved and does focus on enabling the private sector to achieve the objectives set out under the RMI. These activities should continue, and the results of EU funded projects need to be evaluated and disseminated further to promote the uptake of their recommendations, where viable.

In addition to these activities, some of the STRADE recommendations presented in this report suggest a 'return to basics' of promoting investor interest. Access to information, best practice regulations and standards and marketing and promotion, still play an important role in advancing a mining sector.

This report, based on the findings of the STRADE project, summarises the challenges facing the EU mining sector in attracting greater investor interest. The recommendations, which form the main body of this report, focus on the actions that can be undertaken by the European Commission to promote the EU mining sector.

The objective of the promotion recommended by STRADE, reflecting the aspirations of the RMI, EU Industrial policy and the actions under the SIP are as follows:

1. Increasing investment interest, particularly at the exploration level, to attract companies to the EU.
2. Create an enabling environment for the private sector to act as the main tool for increasing domestic mineral production.
3. Environmental sustainability, social rights and impact mitigation to be maintained at the highest standard, under any mineral production related activity that takes place in the EU.

4. Respect the sovereign right of a Member State to determine the prospects for its domestic mineral sector
5. Support the private sector in innovation & research (particularly the ancillary service providers) in developing further efficient and green mining technologies.
6. Support EU Mining Sector, by expanding the outreach and marketing strategies in third countries.

1.3 Why is it important to have EU based mineral production?

The EU sources its raw materials from a number of diverse regions, as discussed in STRADE's reports on EU engagement with Industrial Countries, and EU engagement with Developing and Emerging Countries. However, it is important for domestic mineral production to also continue within the EU. In this section, the report explores some of the reasons why this is important.

Access for the EU to raw material supply is dependent on two factors; first, the physical availability of raw materials and second, the conditions under which these minerals are extracted. The first is discussed under economic sustainability and strategic factors, while the second is discussed under environmental and social sustainability.

1.3.1 Economic sustainability

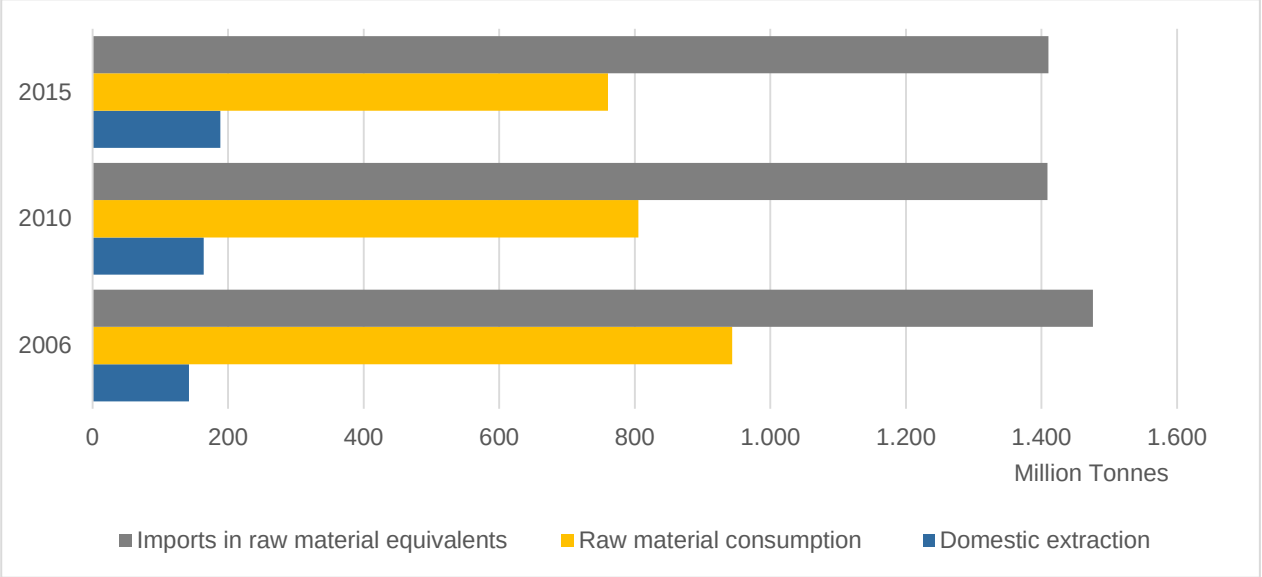
From an economic viewpoint, access to raw material supply refers to the availability, whether through domestic sources or through international markets, of the minerals (concentrates or refined) that are required for EU industry and infrastructure sectors. In addition, this supply should not be subject to unexpected price swings or be prone to supply disruption. There are two sources of raw material supply for the EU: domestic and international.

Domestic supply. Domestic mineral production in the Member States accounts for a small share of EU mineral consumption (Figure 5). The domestic supply comes from both secondary (recycled) and primary (mined) production. Domestic primary production is not expected to increase over the next fifteen to twenty-year period, and the EU will remain import dependent for most major metals[6].

International supply. International supply for most minerals comes from a diverse range of countries. The current global exploration and production levels appear appropriate to meet EU and global demand. However, this balance requires stable conditions in at least some mining countries and may be more acute for some minerals (for example battery minerals) than others.

[6] See STRADE Policy Brief 02/2017 EU Raw Material Import Flows for more details.

Figure 5 EU domestic production & usage



Source: Material flow accounts in raw material equivalents - modelling estimates - EU Stat

1.3.2 Strategic factors

From an economic viewpoint, as long as materials are available, at a lower price internationally than the cost of producing these domestically, import dependency is not a critical issue. Providing international mineral markets function, access to physical supply is not an economic risk. However, there are some inherent strategic risks.

(i) Production risk – limited producers. Perhaps best embodied in the Critical Raw Materials list, the risk of being dependent on one or two countries or from only a few mining companies for supply is a strategic risk. It should be understood that the risk does not come from the physical limitations of supply – higher prices would induce more projects to be brought on line and therefore increase the physical supply of these minerals.

The EU industry itself is not too concerned about physical raw material availability– it is able to source its materials from global markets as well as intermediate products from countries like China. It is price volatility and increase in price levels, particularly if they are not the same for all competitors, that is of greater concern. The positive impact of the Critical Raw Materials list has been the fruitful research on recycling and resource efficiency of such minerals.

For selected raw materials high market concentration by companies or countries is mainly a price issue and, in a few cases, also fear of temporary supply shortages (cobalt, lithium, rare earths etc) due to rapid uptake of technology such as electric vehicles. Excessive price increases can also be tackled by substitution and enhanced resource efficiency in the medium to long term.

(ii) Sourcing risk – China. China has become a major source of intermediate/refined mineral products for the EU[7]. Mineral concentrates from a number of developing countries make their way into EU supply chains, via China. Therefore, the EU may consider it a strategic risk arising from being dependent on China from a geo-political perspective. China itself is a major competitor to the

[7] See STRADE Policy Brief 02/2017: EU Raw Material Import Flows

EU as a global metals consumer and its consumption is expected to account for nearly half of global demand in the foreseeable future. However, China is also pursuing international investments in mining operations, therefore responsible for new supply being brought on line. This report cannot deliver a full analysis on the level of Chinese investment contribution to the current supply levels for individual minerals at this time. We can offer a summary analysis: as long as demand from the Chinese economy supports mineral prices, a healthy supply pipeline in the mining sector will exist. Were global metal prices to fall over a medium period, this would impact the investment decision to build or extend new mines

For the EU, a greater risk is of China sourcing raw materials that have not been responsibly mined and transmitting them through to the EU. As China progresses through/towards a 'new normal', the direction of its policies, particularly on socio-environmental factors for both internal and external mineral production, are becoming more positive, although implementation will take more time. While, the implementation of responsible sourcing schemes in China has mainly been triggered by international customers along the supply chain of conflict minerals and cobalt, there is a growing domestic drive to improve environmental standards in domestic mining as well[8]. Nevertheless, China will be a sourcing risk in the medium term as it will take time to anchor responsible supply chain management in China and in China's overseas operations.

(iii) Resource nationalism – a growing risk? The increase of resource nationalism in some resource-rich countries is noted as an increasing risk within the global mining sector. Resource nationalism is emerging as countries increase the share (free-carry or otherwise) of the government in new mineral projects and not as a nationalisation of mining assets. In other countries, increase in mining royalty payments and taxes (DRC, Tanzania, Mali) have occurred in recent years. Yet others, such as the USA, are using trade measures to promote nationalism, which includes increasing tariffs on refined metal products (such as steel and aluminium).

This has fuelled concerns of the long-term stability of the "free market forces" concept. The impact of resource nationalism is not necessarily a risk applicable to most minerals, as the European industry has a diversified supplier portfolio.

è STRADE recognizes the EU industry's growing focus on the challenge of sourcing of responsibly mined minerals, particularly for conflict minerals, and cobalt, and on improving global resource governance

è STRADE sees the need for considerable attention to be paid to the raw materials dialogue with China; both in working with EU's supply from China as well as encouraging responsible mining practices of Chinese companies abroad.

è STRADE considers the risk of resource nationalism to be low as for most minerals, as the European industry has a diversified supplier portfolio.

1.3.3 Environmental and social sustainability

Broadly speaking, environmental and social sustainability issues cover all non-technical aspects of mining activity, from local community engagement and respect for human rights to mitigating and protecting biodiversity and habitats. These have been codified under a number of best practice

[8] See STRADE Policy Brief 03/2018: China's Approach Towards Responsible Sourcing

standards[9]. In general, the EU expects that the raw materials it consumes are extracted under best practice standards, whether these come from domestic or international suppliers. The codes of conduct laid out under the OECD guidelines for multinationals and for responsible supply chains of minerals, the EU's recent regulations on conflict minerals are some of the examples of EU's perspective on environmental and social sustainability of its mineral consumption

Given the EU's share of global mineral consumption[10] it has an impact on raw material producing countries. Apart from the positive economic contributions for host countries that result from the EU importing raw materials (export and tax revenues, foreign direct investment, transfer of skills and technology and best practices etc.) there are negative impacts as well.

Importing minerals allows the EU (and all other mineral importers) to ***transfer the burden of environmental and social impacts of mineral production*** to the host country. In some countries, domestic regulations and best practice standards aim to have such costs largely managed/internalised by the mining company – for example within Australia, Canada[11]. In other countries, the regulations and/or their implementation are still lagging, and mining companies continue to operate using less responsible mining practices. Where regulations and governance are weak, the sustainability burden is transferred to local communities and governments, which are often ill equipped to deal with them.

The EU acknowledges that it has a ***moral responsibility*** as a consumer of minerals, to mitigate the harm that results from its consumption. Second, it must also honour its ***historical legacy*** where a large number of developing raw material producing countries are former colonies of EU Member States[12].

European consumers, governments and the European mining industry are motivated to pursue globally implemented, high sustainability standards in mining. By encouraging domestic mineral production, under the highest social and environmental standards, the EU demonstrates to others that it is not looking to export its pollution, nor does it set high standards for others, that it is not willing to follow itself.

A global level playing field offers European industry the best competitive conditions and opportunities and prevents distortion of competition from competitors with a lack of environmental technologies.

è The EU must address the risk of transferring the social and environmental burden of mining to third countries, from whom it imports raw materials for its use. EU mining is also important to maintain EU's international credibility in demand global responsible mining. A strong domestic mining sector, adhering to high social and environmental standards, is therefore important.

1.3.4 Co-dependence of mining-tech sector

The mining-tech sector, in any region, is an ancillary industry. That is, its product and services are not directly used by citizens but are inputs into another industry – mining sector for example.

[9] See STRADE Policy Brief 07/2016: Voluntary Initiatives in the Mining Sector

[10] The EU accounted for 17% of zinc, 15% of copper and 13% of iron ore global consumption in 2016.

[11] STRADE acknowledges that the definition of best practice standards still differs between these countries and that there are further potentials for improvements in these advanced mining countries as well as in the EU.

[12] See STRADE Policy Brief 01/2017: Minerals and Metals from Non-EU Countries

Therefore, the drivers of growth for the sector are heavily influenced by changes and trends in the principle sectors it supports.

Many technological developments in the EU mining-tech sector have been made possible by the collaboration with mining companies. Mining-tech sector respondents interviewed for this project agreed European mining-tech sector's global success was the result of such dialogue and cooperation between the few remaining mines and the mining-tech firms in the EU.

It is a mutually beneficial, virtuous circle: without the technical solutions, which mining-tech companies provide, most European mines would not be competitive. Without these demanding and knowledgeable 'domestic' customers, the mining-tech companies would not be able to understand fully the most pressing problems of the global mining industry.

Without the existence of a small, but highly competitive, European mining sector, mining-tech companies are unlikely to be able to retain their leading position in the future. At least it would be more difficult than today.

The interviews indicated that for the EU to support its mining-tech industry it needs to support *mining within the EU*. It is evident that mining-tech relies on the domestic mining industry to stay relevant and credible as a source for solutions. The EU mining-tech industry runs the real risk of gradually losing its leading position, with dwindling mineral activity in the Member States. This may force mining-tech firms to move to other regions, to be closer to the majority of its customers. Therefore, to support the mining-tech sector, a healthy EU mining sector is required.

è The EU mining-tech companies require a competitive European mining sector to keep their leading position in the future and to continue the development of resource-efficient and environmentally friendly mining technology.

In summary, supporting a healthy EU mining sector goes beyond the need to secure physical supply; the objective is to lower the risk of disruption to supply as well as to manage the strategic risk from external dependency. It will also serve a greater political and diplomatic purpose of not being seen as 'exporting' EU pollution but setting an example for other countries by following stringent environment, social and human rights standards within its jurisdiction. A number of STRADE publications address these issues in more detail: Policy Brief 06/2018 – Social, economic and environmental challenges in primary lithium and cobalt sourcing; Policy Brief 01/2018 – Holding European Businesses Responsible; Report 03/2018 - Successful implementation of conflict mineral certification and due diligence schemes and the forthcoming report on EU engagement with resource-rich development and emerging countries. Having briefly described the impetus to support and maintain the EU domestic mining sector, the next section highlights the challenges that have been identified under STRADE.

2 Challenges Facing the EU Mining Sector

Perceptions around a mining jurisdiction, whether based on fact or on reputation, can impact the attractiveness of a jurisdiction for investors. The 'negative' perception of a region as a 'difficult' place to do business can have an adverse effect on its ability to attract investors. The most common issues affecting investor perceptions would be as follows:

Environmental and social regulations. The clarity of environmental and social regulations, and of how this impacts the permitting and production timeline, is important for investors. Mining companies typically want social and environment regulations that are clear as this will reduce project risk and the threat of arbitration. This does not suggest these regulations should not be stringent, just that they are clearly articulated and implemented, and discretionary decision making is limited by the government.

Governance. Governance can be distinguished from legislation/regulations, it focuses on the implementation of the latter. A jurisdiction with a strong governance record (i.e. adherence to its own laws) indicates that although the mining company may have to operate within strict regulations, governance structures and decision making will be transparent and therefore navigable. Stronger governance will lower corporate risk of being exposed to corruption etc as well.

Certainty and stability. Mining companies are not generally concerned about 'strong' regulations, provided they are consistent. Uncertainty is the main threat to positive investment decisions, and mining companies look for assurance that the framework will not change abruptly (even in the event of a change in government).

Regional considerations by investors in the metals and mining sector include geological potential and the operating environment. STRADE's Policy Brief 05/2017 noted that the combination of geological potential and the operating environment determine the mineral investment competitiveness of a jurisdiction. How the jurisdiction compares with other countries will influence a country's ability to attract international mining investment. An 'unexpected' or 'unpredictable' element in a mineral jurisdiction can increase the risk level that investors ascribe to a project. Increased risk can have numerous effects:

- Investors will require a higher rate of return to compensate for the higher risk the project faces.
- To achieve investor returns more rapidly, the life of the mining operations may be shortened by extracting only the higher-grade and more profitable ore.
- Investors may withdraw from the project completely and pursue other, less risky projects, in other countries.

When higher risk perceptions become widespread in a given country, it becomes less attractive as an investment destination.

2.1 The SIP and investor interest

The Strategic Implementation Plan (SIP) focuses on some of the key areas that need to be addressed to improve the investor perception and decrease investor risk in the EU as a mining jurisdiction. The non-technology pillar of the SIP identifies improving Europe's raw materials framework conditions as a priority area, with three further action areas identified. The SIP Action Area 11.1: *Minerals Policy Framework states the objective for an improved minerals Policy Frameworks* as follows [*emphasis added]*:

> The objective is to provide a stable and competitive supply of raw materials from EU sources while promoting good governance and facilitating public acceptance. It will be achieved by strengthening the exchange of best practices in the area of mineral policies and related regulation among Member States, that may lead to *streamlining the permitting procedure along the whole chain of mining activities (prospecting, exploration, extraction, processing, closure, post closure activities) with regard to the time frame, the regulatory co-authority regime*, the financial and administrative conditions, and ensure stable, predictive environment. Another objective is to *increase transparency on raw materials availability in the EU*. Information on exploration, mineral production, trade, reserves and resources should be standardized and systematically reported by EU and Members States, when information is available and without breaching competition rules.

STRADE research would suggest, that while some progress has been made on two important issues; streamlining of mining sector regulations and increased transparency on raw material's availability, further progress is required on these key topics.

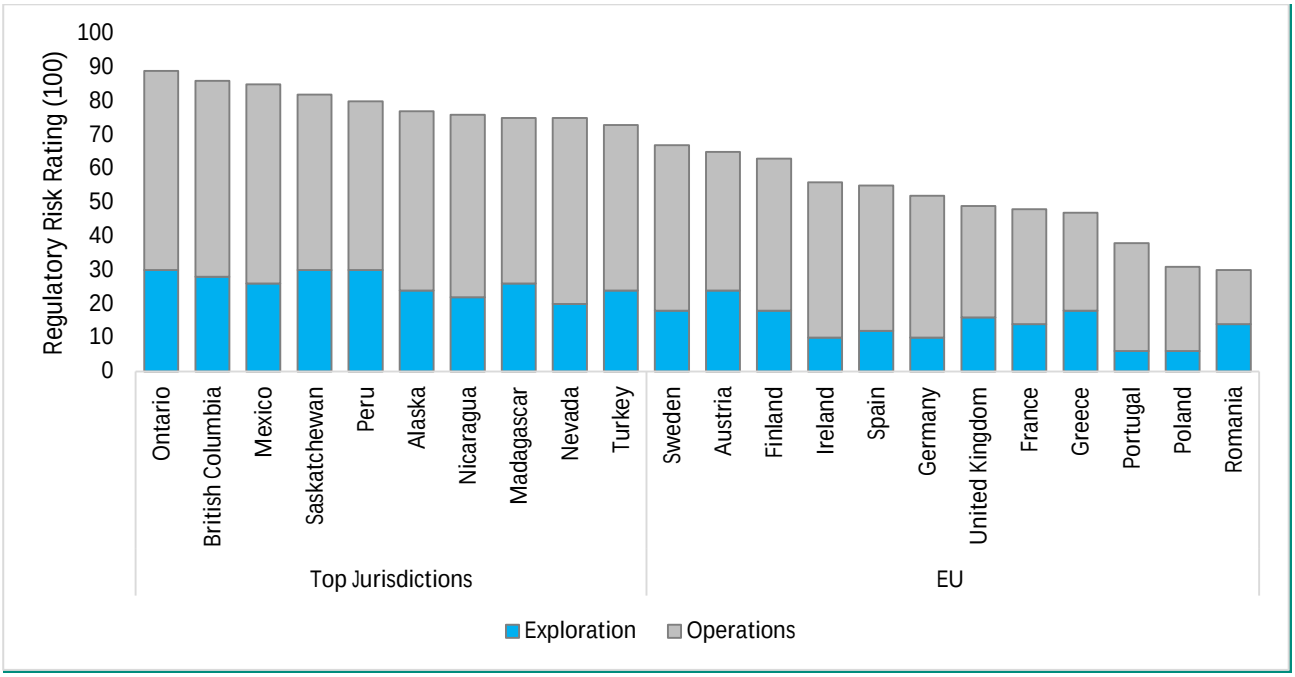
2.2 Key Challenge 1: Mining legislation & investor attractiveness

STRADE's Report on the Competitiveness of the European Union's Mining sector (Report 01/2017) indicated that relative to other jurisdictions, such as British Columbia, Ontario, Quebec and Western Australia, most EU Member States pose significant regulatory risk to investors. This was not linked primarily to the level of regulations (high) but to level of discretionary decision making and lack of clarity in outlining the rules of operations that exist within the mining codes of EU Member States. Figure 6 illustrates the top 10 least risky mining jurisdictions, based on their mining codes and regulations, compared with select EU Member States. The highest ranked EU Member State on regulatory risk is Sweden (ranked 19th in the world in 2018) followed by Austria (ranked 22nd) and Finland (ranked 25th) amongst 121 jurisdictions[13]. Regulatory risk arises at both the exploration and the mining stage; investment risk at the exploration stage is likely to deter further exploration expenditure in a region.

During the regulatory risk analysis, a few issues were specifically identified as being weak in the EU. For a full discussion of these challenges please see STRADE Report on Promoting Investor Interest in the EU Mining Sector, here a brief summary is offered.

[13] MineHutte Annual Regulatory Risk Report (2018)

Figure 6 Mining regulatory risk rating* by jurisdiction



Source: MineHutte (2018)

**100 is an ideal jurisdiction with no regulatory risk – the higher the score for a jurisdiction, the less regulatory risk involved.*

2.2.1 Exploration – first-come, first-served principle

Many EU countries do not observe the "first-come, first-served" principle when it comes to the granting of exploration licenses. The rule is considered best practice as it increases transparency and supports competition. The principle works on the basis of the first company to make an application, having met all the criteria laid out in regulations, has the right to be granted an exploration license. Alternative systems include public tenders; however, these are more complicated and may not always achieve desired results.

In **Austria**'s well-defined mineral code exploration license are awarded in the order they are received – respecting a first-come, first-served principle. In contrast, **Poland** does not follow the principle, and when an application is made, the government issues a public notice to invite other companies to make applications for the same area. The applications are evaluated before a license is awarded.

Finland, Greece, Spain and Sweden explicitly recognize the first-come, first-served principle in their mineral legislation. For the Czech Republic and Ireland, the principle is inferred, rather than explicitly stated in the mining act.

Portugal does not explicitly state the first-come first-served principle and will make decisions as applications are submitted or through a tender process. The Federal Mining Act in Germany (1980), provides discretionary authority to approve the exploration that provides the "best plan for efficient and meaningful exploration". Bulgaria, France, Romania award exploration licenses under a competitive tender.

2.2.2 Right to Mine

The right to mine refers to the legal rights of the exploration company to convert an exploration licence to a mining license and second to transfer the licence to a third party – thereby granting them the right to mine.

Converting exploration to mining license. One of the largest risks to an exploration company would be the inability to transfer the rights for a viable deposit to a third party, as extractive activity is normally not undertaken by an exploration company. In case the company decides to exploit the deposit itself, the greatest risk is to not have the exclusive right to mine a deposit it has discovered.

Regulatory risk analysis by MineHutte, shows that while Austria, Finland, Greece and Romania have very good regulations on the right to mine, Germany, Portugal and Poland have the weakest performance related to the excessive levels of discretionary decision making in their regulations. Sweden and France have adequate performance in this area, while Spain and Ireland could improve their regulations to reduce the risk to investors.

Transfer of mining rights. For large-scale projects, mine life can extend beyond 20 years. The mine operators may change over the life of the mine, and mergers and acquisitions of companies is a regular occurrence. In other cases, a company may wish to completely divest a mining asset. In the case of the former the changes are in the structure of the company and mining authorities normally need to be only informed of such changes. In the case of the latter, the mining title is transferred to a new owner and therefore requires the right to mine to be transferred to a new entity.

Austria, Bulgaria, Czech Republic, Finland, Romania and Sweden allow the transfer of both exploration and mining licenses, provided the new party fulfils the required technical and financial capacity and other conditions laid under the regulations. **Germany** allows for a transfer of rights to take place with the approval from the responsible authorities. Its Federal Mining Act also clearly states why such a transfer can be rejected.

The **French** allow for a transfer of rights, as long as both parties request such authorisation within a three-month period of such a transfer being planned/executed. The ministry retains the right to reject such a transfer if it judges it incompatible with the right to hold a mining title.

Greece allows only for Greek or EU nationals to hold exploration rights. Such rights can be transferred or leased to other parties, subject to the approval of the ministry of industry. The government may reject the application on grounds of 'public interest' or national security, without specifying what such interests entail. The government can also force the compulsory sale of a mining concession if it deems it to be in the interest of the national industry. **Ireland's** legislation does not provide for the transfer of rights and such terms have to be individually negotiated with the ministry during the original mining license application/contract.

STRADE recognises that governments may be using discretionary decision making for the granting of exploration licences and employing discretion in the transfer of licences to control the level and type of mining activity and actors in their jurisdiction. This is not ideal; the correct tool must be used for following mining policy objectives. High standards and clear guidelines are more appropriate to manage the mining sector than discretionary decision making by governments.

è STRADE recommends that to increase exploration expenditure in the EU, which is key to developing a healthy mining project pipeline, the best practice principles for mining regulations need to be more widely applied in EU Member States.

Restricting exploration licences and transfers through government discretion may not be the correct regulatory tool for this purpose. Clear regulatory rules would better serve to achieve this goal. The EC, through its support for exchange of best practice under SIP Action Plan, should assist governments to choose the appropriate tools for achieving their mining policies.

The Horizon 2020 MinGuide Project addresses in more detail the domestic mineral policies in the EU Member States and is tasked with developing a Minerals Policy Guide for the region. It covers issues from innovative exploration and good practice cases on minerals policy governance. STRADE directs stakeholders to this project for further and detailed development of the wider EU Mineral policy issues.

2.3 Key Challenge II: Access to geological data and quality of data

Under Action area II.2: *Access to Mineral Potential in the EU*, the objective of the SIP is stated as following [emphasis added].

> Objective of this action area is to ***foster access to known and still undiscovered mineral deposits***, improve the conditions for sustainable access and supply of raw materials in the EU and safeguard the mineral wealth for future generations by classifying within a regulatory framework, the importance for society of certain mineral deposits… This would ensure an appropriate time frame for long term investment into minerals extraction and processing/refining.

STRADE has looked at the access to data and information[14] issue under the SIP II.2, as it is considered key to reviving exploration interest in the EU region. The EuroGeoSurveys' European Geological Data Infrastructure provides a host of information and individual country geoportal webpages also provide in-depth data. However, this data itself is not enough. Locations of operating and historic mines and primary and by-product metals production data is useful. Geological maps must include overlays for both regional and local details. Key data that exploration companies seek is geolocation data attached to each project and digitised geological maps is considered best practice. Further work needs to be carried out to achieve this. This would include the following actions to be undertaken.

Mining rights management system. A centralised database, which focuses on exploration results rather than operating assets, is ideal. This should include the drilling results and assays for greenfield projects, even if these ventures did not proceed to mining operations. It should be noted that Europe is not lacking exploration activity because of a paucity of information; it must be one of the most surveyed parts of the world. Making this data accessible is the key. A centralised Mining Cadastre system for the EU is strongly recommended. This work can either be undertaken through EU funding of geological survey consortium or outsourced to commercial firms such as Spatial Dimension.

è STRADE recommends the construction of a Mining Rights Management System at the European Commission, to be the first step for exploration and mining companies seeking to identify potential projects. Investors can then progress to Member States for more detailed information.

[14] Please see STRADE Report 02/2018 for a more detailed discussion.

The next box summarizes the main documents and data which must be provided by the Member States to enable a fully operational Mining Rights Management System:

Outline for a fully operational mining rights management system and MS data and information provision:

Template document on securing exploration/mining licenses. Each Member State should have a clear and concise, and ideally comparable, document on 'How to secure exploration/mining licenses'. These would be simply laid out with electronic versions on a communal website, with links to more detailed documentation.

Comprehensive geological maps. A suite of detailed geological/geo-physical maps of all prospective regions should be readily, and freely, available to exploration companies. Ideally, the contact details would be included of a local geologist who could explain regional features and assist in follow-up work.

List of available exploration and mining licenses. A comprehensive list of all exploration and mining licenses should be posted on government websites. The document would contain details of the license (grid references, location map, geology, history of exploration, local issues, current permit holder and expiry date), and be regularly updated (perhaps quarterly).

2.4 Key Challenge III: Increase social acceptance inside the EU

Under the SIP Action Plan, a key Action Area is identified as II.3: *Public Awareness, Acceptance and Trust*. The objective under the action plan is defined as follows [emphasis added]:

> The initiative, mostly industry-led, but also supported by all concerned stakeholders (communities, institutions and regulatory bodies at all levels – local, regional, national, European – medias, NGOs, academia, schools, etc.) is dealing with increasing at first the public awareness of the benefits and potential costs of the raw materials supply, secondly *obtaining its acceptance and finally gaining the trust for the activities of the sector throughout its production cycle*. This action area aims at enhancing public acceptance and trust by *improved communication and transparency*, notably during the permitting procedure and the production cycle (exploration, mine operation, after-mining).

STRADE research has identified social acceptance (as opposed to social licence to operate) as a contributing factor to the perception that the region is not 'open for business' to international mining investors. While the social licence to operate concept focuses more on local communities and their reception of a mining project, the social acceptance term applies to the wider attitudes towards mining activity. It should also be noted that preliminary analysis of social media (twitter ang blog posts) suggests that it is not the opposition to the importance of minerals and metals in everyday lives that is the cause of social un-acceptance nor is it the beneficial economic impact that local communities may receive from mining project. It is the mining process itself which is seen to cause environmental damage and the suppression of social and human rights that may result from mining company activities, particularly in third, non-EU countries. Therefore, in addressing social acceptance, it is important to distinguish which cause of the negative perception is being tackled.

Social license to operate is one of the biggest challenges in bringing new projects on line in Member States (and globally) and without a more positive perception being developed, this will continue to remain a challenge.

To address this, a public awareness campaign is warranted. This would educate EU citizens on how mining practices have progressed in Europe; the community engagement models that are employed; the stringent regulations on protection of environment that are applicable in the EU and the efforts for better technology and resource efficiency that is being funded by the EU. These need to go beyond the stating of regulations that exist and showcase the results that have been achieved at operating mines to allow for a more informed engagement between the EU citizens and the mining sector.

è While it may be felt by some stakeholders that the improvement of the public perception of mining is the mining industry's responsibility, given the importance of minerals and metals for the health of European economies, STRADE recommends the EU consider creating citizen awareness campaigns as part of its responsibilities.

One aspect of Horizon 2020 funded MIREU Project focuses on the social licence to operate in the EU Member States and looks at sharing best practice and knowledge from regional stake holders. As the project is fully focused on this issue, STRADE leaves in depth recommendations to this project. The one recommendation that STRADE would make at this time is for better informed EU Members of Parliament to support a healthy debate on mining at the EU level.

EU Members of Parliament. Part of the process of building public trust in mining activity requires political leaders to engage with their constituents on mining activity. STRADE does not in any way or manner propose that the EU should instruct politicians to be advocates for the mining sector. We do suggest, however, that an internal awareness campaign, based on policy briefings and information packs, be specifically developed for politicians, to better inform EU political officials on responsible mining practices in the EU and provide examples, case studies and progress made on these matters in the EU. This will allow Members of EU Parliament, and others, to make more informed comments and have meaningful discussions around mining activity.

è STRADE would recommend developing briefs and information packs for European Members of Parliament that present the latest advances, standards and thinking in approaching responsible mining, within the EU and by EU based mining companies abroad and the importance of minerals and metals for the health of European economies.

This chapter has dealt with issues that can improve the competitiveness of the EU mining sector. This is not to suggest that the sector does not have any strengths, in fact there are many. Cost competitiveness, stable political environments, availability of skilled labour, technology and capital are some of the advantages that the EU does have. In the next chapter, the report turns to capitalising on these advantages within an investor promotion strategy, to attract greater interest in the EU mining jurisdictions.

3 Investor Interest Promotion Strategy

Under the SIP Action III.5 on *Investment Activities*, the objective includes promoting investor interest in the EU mining sector. In Chapter 2 this report addressed the need to provide comprehensive geological data through a centralised mining information management system and improving the regulatory conditions in Member States to be more transparent, to assist potential investors to evaluate potential projects. In this Chapter, the report turns to a more basic investor interest promotion strategy, that include the creation of a one-stop-shop and targeting specific investor groups.

3.1 The One-Stop-Shop

The One-Stop-Shop is not a new concept and is widely employed in a number of sectors to attract investors. It refers to the creation of a centralised repository of information that is required for investors, as a first step for investment. The repository provides basic information on potential projects, the regulations that would be applicable and any assistance that would be made available by the government in terms of finance, tax breaks etc.

In the case of the EU, the One-Stop-Shop's primary responsibility would be to provide information that is required by investment entities, in the first instance, and to direct them to the appropriate contacts in Member States for further information and discussions. **Granting of mineral licences and regulations would remain the remit of sovereign Member States.** Individual Member States can continue with their own mineral sector promotion schemes and liaise with the One-Stop-Shop as they see fit. The function of the unit could additionally include the following:

Relevant legislation in all EU Member States. A report (updated annually) should be made available that summarizes the metals and mining legislation in all of the EU Member States. This would be an easily-read, and concise, summary of the relevant legislation, with links to more comprehensive documentation.

Brochure of latest mining-related developments. A regular (quarterly) brochure should be published that outlines all metals and mining developments (new exploration projects, mine start-ups, financing etc) within the EU. This publication would be distributed at conferences and also available in PDF on a central website.

è STRADE recommends the setting up of a One-Stop-Shop for investors, where information should be organised under the EU umbrella, providing a first step for interested investors and exploration and mining companies. Such services can be incorporated under the EU Investment Policy, with the appropriate unit building some level of mining competency to manage basic promotion activities.

3.2 Basis of a marketing strategy

The one-stop-shop functions to provide investors who are interested in pursuing projects in the EU. In order to attract investor interest in the first place, a marketing or investor outreach strategy would be required. The following principles can be used for such an outreach strategy. These concepts are standard practices in most investor promotion strategy.

3.2.1 Highlight comparable advantages

Mining investors generally have a good perception of the EU Member States for economic policy, labour productivity and skills, infrastructure, and proximity to market. For these issues, the only requirement of a promotion strategy would be regular reminders of these positive features to potential investors.

There are also issues on which mining investors have a poor perception, and for which the EU (either generally and/or amongst its Member States) ranks comparatively badly on a global basis. These issues include mineral prospectivity (ie there is generally less-favourable geology), investor perception, and right to mine.

To highlight the EU's comparable advantages, the following content should be promoted under investor promotion strategies.

Cost competitiveness. EU mining operations compare well on a global basis but there is nevertheless an unfavourable perception that costs are high. These include; operating costs, and taxes and royalties payable. Accordingly, these issues would benefit from aggressive marketing to highlight the comparable advantages, and to correct mistaken perceptions. As STRADE's Policy Brief 08/2016 on *The Cost Competitiveness of Mining Operations in the EU* highlighted, European mining operations are competitive with other regions.

Geological maps showing main prospective zones in Europe. The EU, by some actors, is thought to offer limited geological potential. This is a perception that can be addressed by making available the geological information within the EU, through providing better and more accessible information and devising a competitive Mining Rights Management System (see chapter 2.3). A series of maps should be made available in several formats to ease exploration investigations by potential investors.

Booths at major mining conferences. A communal booth should be designed and staffed at the leading trade conferences and trade shows, for example Mines & Money (the London event especially), Mining Indaba (Cape Town), Diggers & Dealers (Kalgoorlie) and PDAC (Toronto). This booth would showcase the mineral potential of the individual Member States, and of the EU as a whole. Individual member countries could be offered positions within the booth to promote their respective regions.

The EU's promotional booth at the PDAC conference in March 2018 was a positive step in this direction. The accompanying sessions on EU country profiles, with senior ministers presenting their cases, was also well structured. Such participation should become the norm at future events.

Articles in leading trade publications. To assist in improving investor sentiment towards mining in the EU and its Member States, regular articles should be targeted in the leading trade publications (with the UK's *Mining Journal* and Canada's *Northern Miner* being the prime targets as these publications are widely read by mining company executives). These articles would ideally focus on local exploration activity and any changes in mining legislation or fiscal regimes.

3.2.2 Target investment groups

European mining companies. Mining companies based in Europe spend only an estimated 15% of their global budget within their host continent, compared with comparable percentages of 38%, 40% and 57% for Canada, USA and Australia-based companies, respectively[15] (S&P, 2017 data).

These companies should be a priority for the EU's promotion strategy, with targeted correspondence and follow-up meetings (ideally with the relevant Mines Ministers). Attention could be drawn to the favourable operating environment in the EU compared with Africa and Latin America, where much of the exploration expenditure is currently being targeted.

Perhaps also some form of fiscal encouragement could be made at the national level (similar to the Flow Through tax credits offered for Canadian exploration).

Mining companies not based in the EU. These companies represent a significantly harder target but form the bulk of the potential additional investment into the EU Member States. The promotion strategy could identify companies active in those particular third-party countries where a case can be made that the EU offers a superior investment opportunity (ie geologic potential plus operating environment).

Executives of these companies ought to receive personal invitations from Mines Ministers to visit prospective sites in the EU member country. These invitations would be hard for executives to ignore, especially if they coincide with appropriate nearby conferences (this is already accepted practice in southern African countries, e.g. the annual Indaba conference in South Africa).

Financial investors. Every mining project represents a unique set of investment circumstances and investing institutions will look at them in isolation. Nevertheless, documents that demonstrate the long-term financial and political stability of the EU Member States will support the use of lower discount rates when investors evaluate the net present value of these projects.

è STRADE recommends that the EU to design an investor focused promotion strategy, under the SIP, where the geological potential and comparable cost advantages is presented to potential investors in easy to read and access format. This recommendation focuses on an active European and international investor engagement strategy, that can be carried out under the larger EU investment Policy.

[15] S&P data – STRADE Report 02/2018 Promoting Investor Interest in the EU Mining Sector

4. Supporting Mining Technology Companies

4.1 Maintaining a competitive EU mining sector

The mining technology sector depends on the health of the mining sector for its growth and expansion. While STRADE research has indicated that the there is little need for direct and active engagement to support the mining-tech sector itself, it is the wider minerals sector support that would be considered beneficial. If the mining sector does well, the mining-tech sector will also exhibit strong growth and create employment opportunities. The following issues have been identified for the EU mining-tech sector.

Diminishing EU mining production. The gradual diminishing of the European mineral production could lead to serious problems, as this weakens the cluster in which the European mining-tech companies excel. With the number of clients and research-partners decreasing, it would be challenging for the industry to remain at the forefront of technology.

Market access abroad. The mining industry is expanding at a faster rate abroad than in the EU. This could potentially lead to EU mining-tech companies moving towards their main markets outside of the EU. Alternatively, EU mining-tech companies need to expand their operations, through exports and joint ventures, to access new markets at greater geographical distances.

Proprietary technology. There is a trend towards the development of propriety technologies, outside mining-tech firms. The largest mining companies demand exclusive right to technology developed in a joint venture with an equipment supplier. This can narrow the client range for mining-tech firms, and limit their revenue growth. Such arrangements can also limit the profitability of developing new technology. Additionally, with one or two mining companies holding proprietary rights, it slows the uptake of best available technology by other mining companies.

Access to research clusters. There is a concern among the interviewees consulted for this project about the long-term availability of skilled labour within the EU. The technological achievement and advances made within the mining-tech sector are influenced by access to research and development and a skilled labour force. While mining-tech firms will have R&D units that focus on new products and addressing customer requirements, part of the innovation is driven from outside these firms. Within the EU, the historical clustering of academic institutes with mining companies and equipment suppliers, has allowed the sector to maintain a competitive global edge.

To remain in the global forefront and the continued strengthening of the European mining-tech sector the following factors are important:

- The mining cluster, including mines, mining-tech companies, local stakeholders and academia, best thrives when considered as an integrated whole – without any one of the nodes the cluster weakens. There is a need to present the cluster internationally and present a unified front to the rest of the world.
- The European mining-tech sector can play an important role globally in the environment and health & safety areas. Technologies developed in Europe in response to stricter regulations locally can be exported and used as regulations become tighter globally, giving the European mining-tech companies a competitive advantage.
- While there are many national industry associations, there are only limited links and co-operation across borders between different EU member countries. This is an area where

the EU could play an active role and promote intra-EU co-operation between the major mining-tech exporters.

- The four areas identified, mine closure and rehabilitation, health and safety, responsible mining and the internet of mines are growth areas where the EU mining-tech industry has a competitive advantage. The areas are also of importance for continued mining within the EU. The four areas merit support from the EU and could act as a means to increase global sales for the EU mining-tech industry.

The STRADE Policy Brief 04/2017 argued that the current global trend of the mining-tech industry and the mining industry could be divided into four main categories of factors influencing and driving mining technology development:

- Increased productivity, and cutting production costs
- Energy/water efficiency, reducing energy and water usage
- Responsible mining, limit environmental impact and reduce footprint both ecologically and socially while taking greater socioeconomic development responsibilities
- Health & safety reduce accidents and improve the health and safety situation for miners and neighbours including a more gender-neutral work atmosphere.

Further, the overriding trend, linking all these factors together could be described as the 'Internet of Mines'. Through digitalization, companies are trying to remote operate machines, connect machines with other machines, make machines self-diagnosing, monitor employees in the mines etc. These efforts increase the effectivity in the mine and/or the processing plant, logistics, as well as increase safety measures and make the processes more sustainable.

European companies enjoy a good reputation in this field and have an advantage through development of advanced technology in comparison to many of their competitors. While strict EU regulations and high cost labour has pushed companies to perform better than average within these areas, other regions are following. Therefore, the demand for such technology will increase, and with it the supply from non-EU mining-tech firms.

è For the EU, supporting mining activity in the EU would be the primary support required by the EU mining-tech sector. Capitalising on the Member States investment promotion strategies for their companies abroad, could be further complemented by the EU including mining and mining-tech firms in its promotion activities at foreign embassies.

4.2 Support for EU mining & tech firms abroad

EU based mining companies as well as mining-tech and services industries operate in a number of third regions. The business practices of mining companies abroad will be first determined by the geological potential of the third country, followed by the ease of doing business in that jurisdiction. EU mining equipment firms will tend to 'follow' their clients, and therefore will be found in countries that host mining operations. The ease of doing business in these jurisdictions will influence the scope and extent of business generated by these equipment and service suppliers.

To balance the slow growth of mining activities in the EU itself, promoting the business activities of EU firms abroad will be helpful in expanding their business activities.

Such support and promotion fall under two categories. The first is an active engagement with EU based firms to provide them information, details and networking opportunities to explore business

ventures in third countries. The second is a more passive role, in improving the business and operating environment in third countries, such that EU companies are able to operate there. This is particularly relevant for developing countries with weak governance, where EU companies may find it challenging, as well as costly, to operate while adhering to the high standards set under EU regulation and share-holder expectations.

For example, the EU has strict directives on corruption and transparency of payments to governments, its companies are expected to adhere to high environmental, social and human rights standards. Operating in business environments where such norms do not exist and competing with other firms that do not follow the same standards, can be a major hindrance for EU companies to expand business abroad.

4.2.1 Direct business support

Foreign trade and investment departments and agencies across EU member states have traditionally supported their companies (across many sectors) in gaining a business presence in emerging markets. These approaches can range from financial support (funding credit through Ex-Im Banks), local government relations (through embassy support), business opportunity identification (through trade delegations and hosting business-to-business events) and provision of market information (Fact Pacts).

In general, support for the mining and mining-tech companies abroad will fall under the wider investment support strategies of a Member State. Given the size of the mining-tech sector, there is no apparent need to draft a separate strategy.

Steps to Success - Sweden

Information sharing. Based on the investment needs, share insights on the country's business sectors, the domestic markets, the investment climate, R&D, specific competence clusters and investment costs.

Location management. Based on the investor requirements, support in identifying sites for your operations in the country.

Investment opportunity search. Based on the investor's priorities scan, identify and present business opportunities in the country, give advice on key industry stakeholders and help identify the next investment step.

Matchmaking support. Introduce various opportunities of strategic partnerships, investments and other types of cooperation.

Establishment information. Provide information on how to set up and run a business in the country, including rules and regulations, legal entities, employment taxes and more.

Directly supporting both the mining companies and mining equipment manufacturers abroad is normally the remit of individual Member States. However, given that the EU maintains international embassies in a number of countries, that support all its Member States, such international promotion can also be undertaken at the EU level.

Assisting EU based SME's. Larger mining and mining-tech companies usually have their own infrastructure and resources in exploring business opportunities abroad. However, small and mid-size enterprises (SME) often lack both the experience and the financial resources to take up opportunities outside the EU. These companies should continue to be supported through current programs run by Member States and the EU, that include local trade support offices in countries of high interest, business opportunity identification and provision of market information etc. (see for

example Business Sweden's approach to promote their companies abroad, described in the box above).

4.2.2 Indirect support – creating an enabling environment

An important aspect emerging from the interviews conducted for the mining-tech companies (to some extent depending on their size) do not want or need direct support from the EU. There is however, a need for creating an enabling business environment for companies abroad. Support in combatting bureaucracy, corruption, red tape etc., in the markets the companies are targeting would be beneficial.

The EU and the Member States are active in programs that support better governance in third countries. In the long run, the resulting better business environment might be beneficial for EU companies. However, it is not expected that short-term results can be achieved, since the related challenges are very complex and the transformation in developing and emerging countries needs time. For a full discussion on this topic, please see other STRADE publications on Socio-Economic Issues.

4.3 Raw materials research and innovation coordination

The third pillar under the SIP focuses on international cooperation on a number of areas, including development of (III.1) technology, (III.3) improving health, safety and environmental performance, (III.4) skills and education and knowledge. While under the SIP these are noted as opportunities for external collaboration, it is important to note that domestic collaboration, within the EU, is also required to support this sector.

The SIP includes reference to *Improving R&D&I coordination* in the EU (I.1). The current links between research institutions and the industry should continue to be supported, and as stated under the SIP, such clusters should be expanded to include institutions from non-EU countries as well. There are support facilities available within most of the areas and these recommendations encourage the maintenance and further support of the following:

Applied research and development. Projects that focus on the application of research within the mining sector should be continued to be encouraged. This applied research can be for the four areas discussed in the previous chapter. However, the research does not need to be limited to the EU, and projects with a similar focus in non-EU resource-rich developing and emerging economies should be considered.

Education and training. Engagements with developing and emerging resource-rich countries should also include education and training. Through distance education, student and staff exchange programmes, European universities could educate the next generation of engineers and machine operators in several countries. In return, European universities could benefit from resource-rich countries' faculties with greater experiences in mining and related sciences teaching EU citizens. Training exchanges need to go both ways. Currently funding is available for non-EU academics to join EU universities, there should be programs to encourage European researchers joining institutions in, but not limited to, Australia, Canada, Chile and South Africa.

Link skill training to equipment sales. All modern equipment and systems need a skilled operator with sufficient general skills background and training. It is often difficult to find the right skills in many countries, particularly as mines are increasingly located in remote areas and countries. By linking the mining-tech companies, a virtual reality training provider and a university

or training institution these problems could be at least partly solved and turn into a “win-win” situation. It is important that whatever education is provided must be transferable to other economic sectors in the emerging and developing economies, thus creating spill over effects that can be used for the overall development of the economy.

è The current EU support for R&D and innovation activities for the mining sector should continue for those involved in mining technology and innovation research.

Inclusion of communities. One element missing from the current clusters is that of communities. While mining-tech, mining firms and academic institutions form most clusters; the areas of technology they are developing are reflections of community demands. Without the inclusion of communities, these clusters may remain limited in their scope. Communities can be included in a number of ways; social science departments from universities could be engaged, local governments and councils and civil society could be involved. Companies with expertise in social media and how Generation Z (those born in 2000 and after) engage with social and environmental causes could be included. It is not enough to bring new technologies to the market; effort is also required to communicate the impact of such strategies to the wider public.

è Mining technology research and innovation should also include communities as stakeholders, and the gap between technical knowledge and innovation and community and citizen perception around such technology could be included for research funding opportunities under the current research and innovation EU funding schemes.

5. Conclusion

STRADE research indicates that there are strategic reasons to support the EU mining sector, which are not directly related to securing access to physical supply from domestic sources. A strong EU mining sector can contribute to the perception of the EU as a region with strong social, environmental and regulatory standards, which continues to pursue mining activity and is not looking to ‘export pollution’. The EU mining-tech sector, which is recognised as a leader in the international sector, will also benefit by working closely with mining operations and centres of innovation and research, to produce more efficient technology for the global mining sector.

The analysis of EU mineral production levels suggests that very little progress has been made in increasing exploration expenditure in the region and for base-metals at least, production is not expected to increase. While current EU mining support mechanisms (SIP and Horizon 2020 funding) should continue, there needs to be a focused investor promotion strategy. This needs to address three important issues; improving the mining regulations in Member States; better organised access to geological data and finally addressing the issue of negative social perceptions around mining by EU citizens[16].

STRADE recommends that to increase exploration expenditure in the EU, which is key to developing a healthy mining project pipeline, the **best practice principles for mining regulations** need to be more widely applied in EU Member States.

[16] Please see Table X, pg of this report for the STRADE recommendations corresponding to specific SIP action plans.

Restricting exploration licences and transfers through government discretion may not be the correct regulatory tool for this purpose. Clear regulatory rules would better serve to achieve this goal. The EC, through its support for exchange of best practice under SIP Action Plan, should assist governments to choose the appropriate tools for achieving their mining policies.

The construction of a **Mining Rights Management System** at the European Commission would be recommended, to be undertaken from a commercial investor prospective, to improve the access to geological data and licences. Investors can reach out to Member States for more detailed information.

The report recognises that while it may be felt by some stakeholders that the **improvement of the public perception** of mining is the mining industry's responsibility, given the importance of minerals and metals for the health of European economies, the EU needs to consider creating citizen awareness campaigns and provide more information to European Parliamentarians as part of its responsibilities.

To create more investor interest, a **One Stop Shop**, operating under the umbrella of the EU is recommended, to be the first port of call for international investors seeking information about projects, regulations, codes and support for mining projects in the EU Member States.

For the mining-tech sector, support for the domestic EU mining sector is required. In addition, the current EU funding for research, development and innovation should continue. One further aspect of research that could be added here is the meeting of mining technology research and innovation and communities who are impacted by innovation and technology.

The SIP and EIP documents indicate that there is a good understanding of the factors that will promote mining in the EU, these need to be matched with raising investor interest and participation.