

CRITICAL METAL VALUE CHAINS

Deep dive into barriers and policies
for a battery value chain

Tillväxtanalys
31 August 2017

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1 INTRODUCTION

A deep dive into a 'battery value chain' and supporting policies

A DEEPER LOOK INTO THE BARRIERS IDENTIFIED

In our report from March 2017, *Opportunities for new metal value chains in Sweden*, we found that value chains in special alloys and permanent magnets based on rare earth elements and battery manufacturing based on graphite and lithium mining could possibly develop in Sweden by building on existing strongholds in mining, finance, energy, chemicals and motor vehicles. We also found, however, that a number of barriers that could hinder the value chains from developing on their own were present as well. Especially, we found that both green tech products intense in rare earths' and lithium-batteries were characterised by extra ordinary high risk that needed be addressed through innovation policy, coordination across stakeholders along the value chain and through a stable regulatory regime.

The aim of this analysis is to dig a bit deeper into the barriers for a battery manufacturing value chain in Sweden and policies that could remedy them. To remain concrete, we have focused specifically on the graphite-battery value chain.

As a main source of input, we have conducted a number of interviews with various stakeholders along the value chain, academia, and governmental stakeholders (see appendix for a complete list). We also depart from the research and knowledge of the graphite/graphene value chain obtained in the March report.

The previous report and policy implications



Source: Copenhagen Economics

Revisiting the graphite value chain

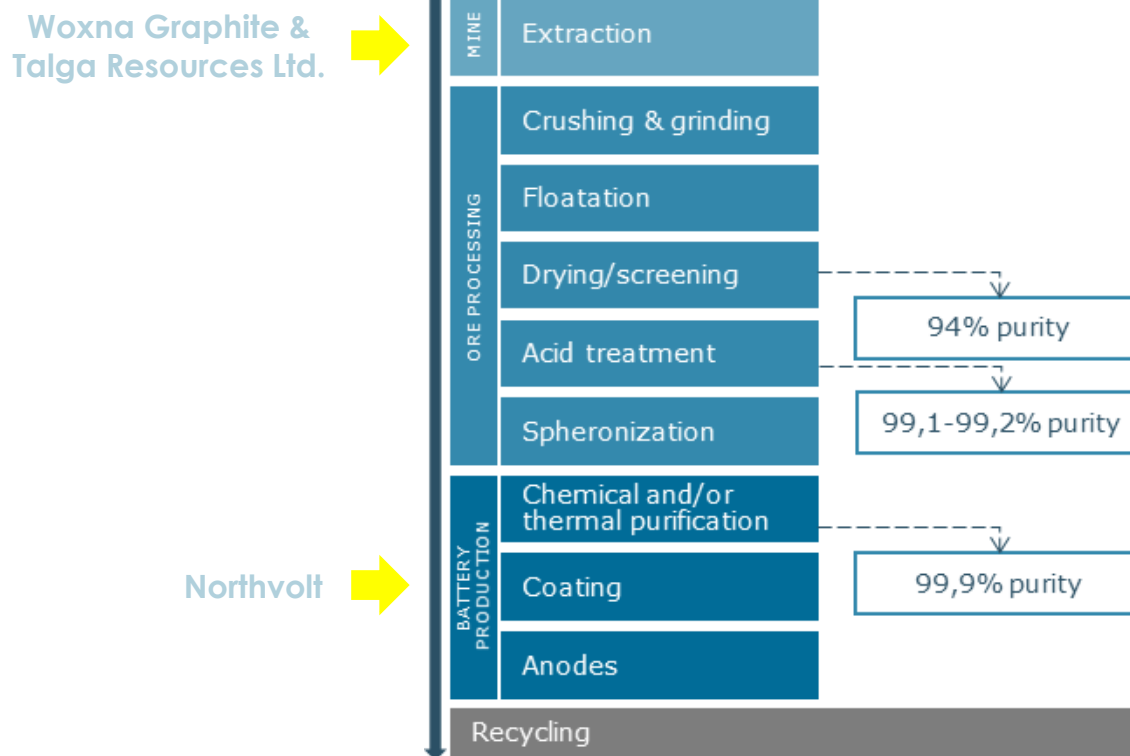
THREE TYPES OF RISKS

In the March report, we discussed three types of risks characterising the immature markets of lithium-ion batteries (and technologies utilising graphene), namely market risk, technological risk, and institutional risk.

Technological risk is high because lithium-ion batteries are still evolving and no specific formulation is yet dominating the market. Competition with other battery technologies, such as nickel metal hydride batteries, is significant. Hence, companies involved in battery manufacturing and research are 'betting on' the dominant technology of tomorrow. The anticipated wave of electrification of modern society leads to estimates of high future demand, but the technological risk and uncertainty regarding future applications and uses of batteries, causes a high level of *market risk* as well. Still, economies of scale are believed to be significant as well meaning that Europe can only host a limited number of battery factories. Several European countries are interested in the high value, manufacturing jobs that a battery factory could bring. Hence, a window of opportunity for getting a vertically integrated (i.e. sourced with Swedish raw materials of graphite and lithium) battery industry off the ground exists now and for the next couple of years.

This highlights the importance of *institutional risk* which we also found to be very much present in Sweden. Several players along the value chain mention long lead times and in-transparency in permitting (following both the Mining Code and Environmental Code) as a major risk to practically all activities along the value chain.

A stylized (natural) graphite for batteries value chain



Note: In Copenhagen Economics (2017) we also looked at the lithium value chain as an integral part of battery production, while the focus of this report is the graphite value chain
 Source: Copenhagen Economics (2017) 'Opportunities for new metal value chains in Sweden'

Non-distortionary policies to reduce risk and spur investments with positive spillovers

8 RISK REDUCING INITIATIVES

We find that a clear signal that a battery value chain is indeed a political priority in Sweden, must be sent to convince companies along the value chain (and their possible investors), that this is not ‘the flavour of the month’ but a solid, long-lasting political strategy in Sweden.

To reduce technology risk we recommend to narrow and focus research and innovation calls, to fund test facilities to bring forward products closer to commercialisation to get ‘off the ground’ quicker, and for cluster policies and networks to have a stronger commercial focus.

To reduce market risk and exploit Swedish comparative advantages, we suggest to introduce a certification scheme for clean and low-impact production of metals and minerals and their value added products (such as batteries). To get this successfully past the introduction period, we recommend a feed-in support scheme to go hand-in-hand with the certification scheme.

To reduce the (increasing) level of institutional risk we suggest to adopt protocols for dynamic and forward looking reporting for mining companies, developing a framework for incorporating the upsides of mining in the overall assessment of mining versus other existing, and potentially irreconcilable, interests and land uses along with mandatory plans for how to realise this potential. Finally, to increase transparency and predictability of permitting processes, especially for mining concessions, we recommend to introduce clear guidance on documentation requirements for applications and to enact timelines for approval.

Technology risk

1. Signal political priority and support to battery value chain through more focused allocation of innovation funds, topical calls and innovation prizes for a number of years going forward

2. Fund pilot and test facilities through Swedish (and EU programmes) to drive down costs of technologies closer to commercialisation

3. Re-ignite cluster policies and network activities to have more commercial focus and be accessible for all interested parties. Make calls for private parties to develop and execute the activities instead of public institution; keep all material and dialogue in English

Market risk

4. Introduce certification of metals, minerals and their value added products that fulfil requirements for a ‘clean and low-impact production’

5. Give feed-in support for reorganised or new production to meet certification requirements for a ‘clean and low-impact production’ from metals and minerals

Institutional risk

6. Introduce TSM-like governance structure for self-regulation for sector to reduce future risk on government side

7. Develop framework for weighing areas of national interest against each other (mining vis-à-vis the others) and introduce into the mining concession application process a standard procedure for assessment of economic potential of mining and a plan for its realisation

8. Ensure more transparency and predictability in permitting by introducing clearer guidance on documentation requirements using checklists and time limits

Source: Copenhagen Economics



2 RISKS

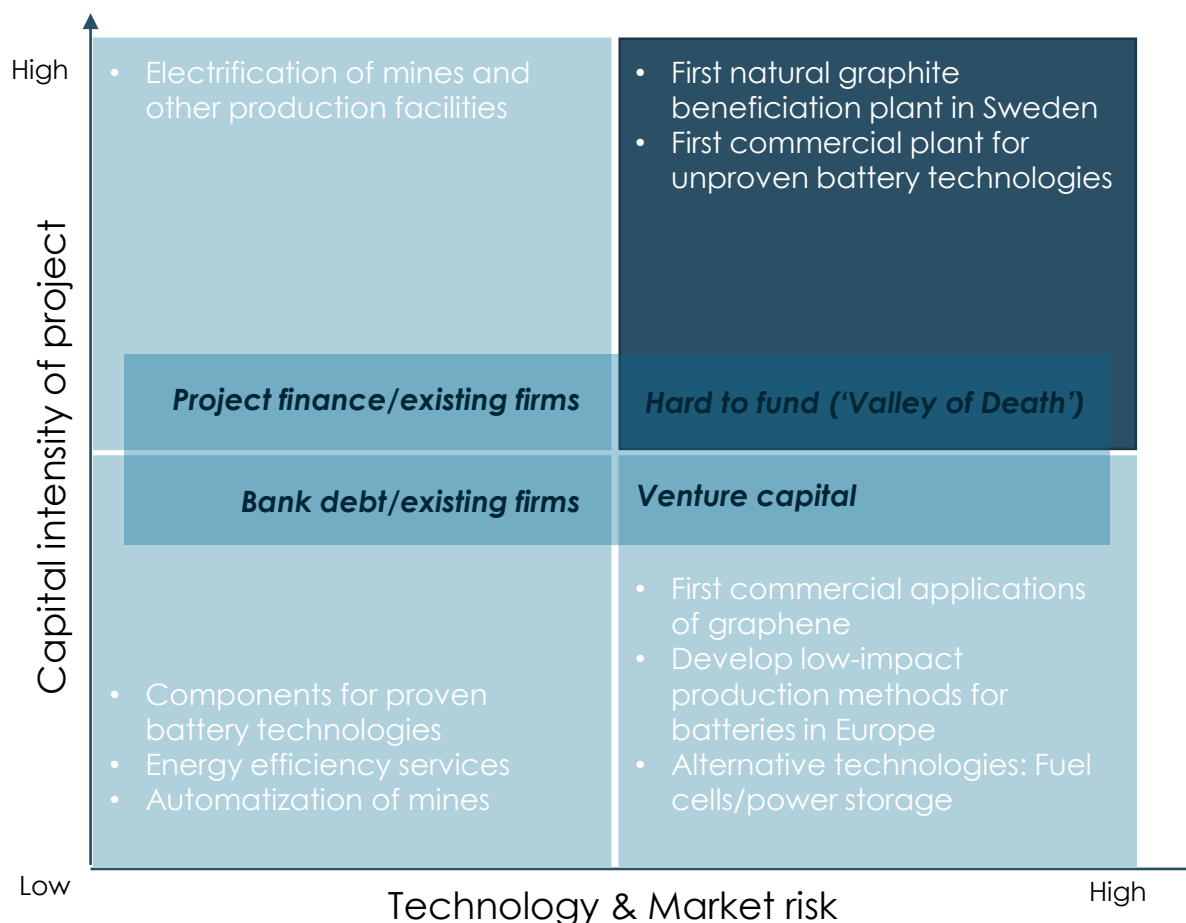
Underlying issues influencing risk profile of graphite for battery production

LARGE HIGH-RISK INVESTMENTS - WITH AN EXPIRATION DATE

Lithium-ion battery production today is characterised by high uncertainty regarding future technology solution and future demand. Coupled with a requirement for quite large capital investments, private investors can be deterred from investing because projects are both expensive upfront *and* very risky, implying an uncertain future return. Projects that fall in this category of being both very capital intensive and very risky are generally perceived as being hard to fund (see figure to the right) or, in more popular terms, that projects are in 'The Valley of Death' as they have a very low chance of survival. It is not unlikely that at least part of a Swedish battery value chain would fall in this category.

Further increasing the riskiness of investments in battery production in Sweden (or elsewhere in Europe) is the current pace of technological development, a massive move towards electrification of products at potential customers as well as economies of scale. Together, this creates a '*window of opportunity*' for getting investments off the ground; get on the bandwagon now or others will have earned the first-mover advantage. In that sense, there is also a large degree of path dependency of previous or current policies defining market outcomes.

Capital intensity and technology risk influence funding options



Source: Copenhagen Economics based on analytical framework from Copenhagen Economics (2013); Efficient strategy to support renewable energy, a report for the Nordic Council of Ministers

Underlying issues influencing risk profile of graphite for battery production

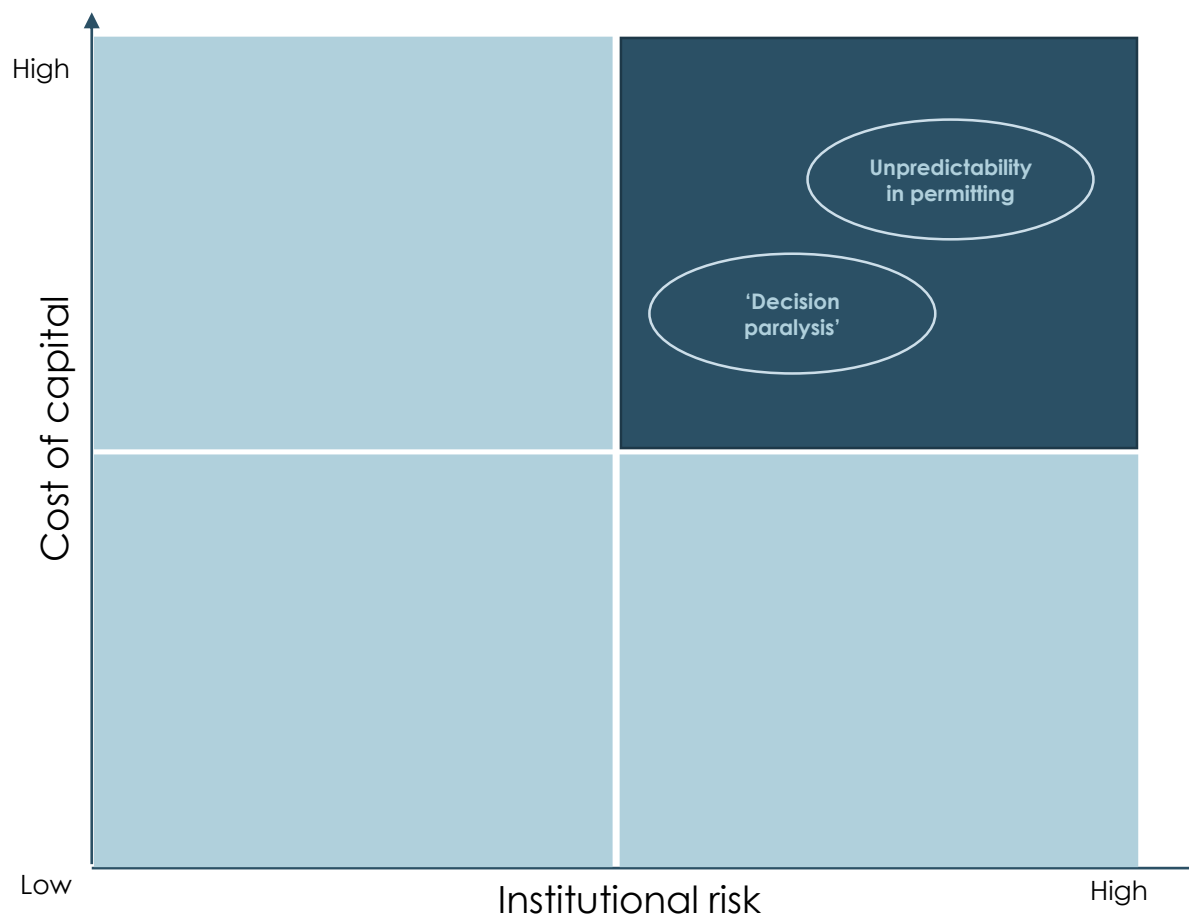
LONG & UNPREDICTABLE PERMITTING

To open a mine or production plant, e.g. an ore processing plant or a battery manufacturing unit, takes a number of permits and licenses in Sweden. The road to full permitting can be very lengthy due to several different institutions and authorities having a say in the process, but also because conflicts over land use may arise and no clear guidance for the balancing of pros and cons of mining and other potentially environmentally harmful activities against other interests exists. As a result, case handling can become subjective and dependent to a large degree on the specific case handler or the specific composition of the county (län) where an application is handed in.

A CASE OF 'DECISION PARALYSIS'

Long-term investments like mines or battery factories are going to have an impact on the surrounding community and area for many years to come, that may, however, be difficult to predict in all possible future contingencies. Generally, humans are risk averse and fear of making a 'wrong' decision today with potential great negative repercussions for the future, may cause authorities to request more information and assessments from the applicant in order to get a 'complete information set' on which to base their decision today. These assessments, however, will most likely not remove the inherent risk of not being able to predict future implications and hence have often not increased 'decision readiness'. The hesitation to make decisions about uncertain future outcomes ('decision paralysis') can extend the permitting time considerably. The Norra Kärr ruling may have added to the uncertainty and insecurity about documentation requirements, also with the authorities.

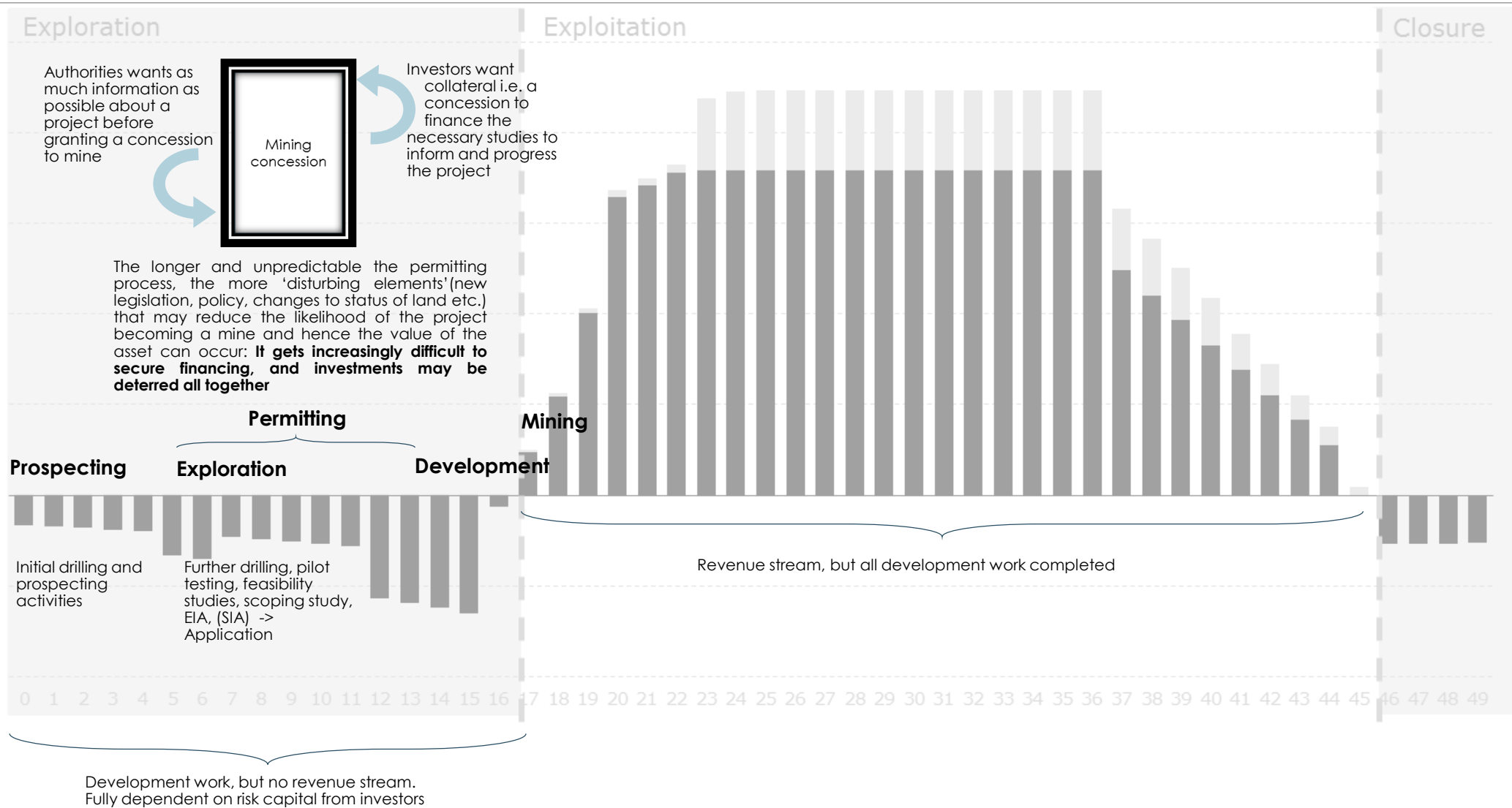
Institutional risk also increases cost of capital



Source: Copenhagen Economics based on interviews with stakeholders across industry, academia and authorities

BOX: Why are long and unpredictable permitting processes a problem?

The dilemma of the risk capital financed exploration company



Note: Illustrative cash flow of an exploration project moving into mining. EIA: Environmental Impact Assessment. SIA: Social Impact Assessment
Source: Copenhagen Economics

Unpredictability in permitting

LACK OF APPLICATION STANDARD

Based on the interviews conducted for this study, there seems to be general satisfaction with the overall permitting procedures in Sweden. However, it has been mentioned that it is somewhat unclear, especially to new-comers without prior experience in Sweden, what a successful mining concession application should hold. This can lead to more iterations between applicant and the Mining Inspectorate (Bergsstaten) and a less efficient use of resources, adding to the barrier of getting started. Some interviewees also highlight the lack of expected or binding timelines for the authorities' response as a source of unpredictability. Especially for companies financed by risk capital, not being able to provide investors with a credible timeline for the permitting process, can make it difficult and more expensive to secure the necessary financing (see box above).

LACK OF STANDARD FOR BALANCING CONFLICTS OVER LAND USE

Another source of unpredictability relates to the process *after* the application has been handed in. The process for weighing a future mine, which undoubtedly will have some negative impact on other considerations such as nature, existing activities (e.g. tourism) or certain ways of life (e.g. reindeer herding), is unpredictable for at least three reasons: *First*, the mandatory environmental impact assessment, cultural heritage assessment etc. all serve to assess the scope of *negative* impacts of mining. No formal tool, however, exists for assessing and discussing the *upsides* of mining, for instance the economic and social benefits arising from a large investment.

In that sense, the current assessment complex is skewed towards the negatives. In other jurisdictions around the world, the applicant often plays a central role in assessing, communicating and realising upsides to the local community and other key stakeholders. Only a few examples of this being carried out in Sweden exists and seems to occur on an ad hoc basis only.

Second, even if positives are included in the overall assessment, it is a difficult exercise to weigh very different types of values against each other. How do we weigh 'hard values' of mining such as taxes and jobs against 'soft values' such as a certain way of life (of e.g. reindeer herding). *Third*, authorities are balancing *existing* versus *future* activities, and it may be difficult to allow future activities to harm existing ones. Hence, in the current regime, authorities are basically comparing apples and oranges.

For the case of so-called areas of national interests (riksintressen), a procedure for weighing different interests against each other already exists (see box below). For example, areas of interest to national defence and security weight higher than anything else, i.e. other interests are secondary. How to weigh other interests against each other follows an outlined procedure by the National Board of Housing, Building and Planning (Boverket). Yet, *no formal tool* for assessment and inclusion of the upsides of mining are, to our knowledge, included in this framework. For the case of a mining area *not* being named an area of national interest, no formal guideline exist for how to weigh that against other activities that are named areas of national interest. From point of view of the applicant, this lack of formal procedures and assessments represents large risk in the form of an unpredictable process.

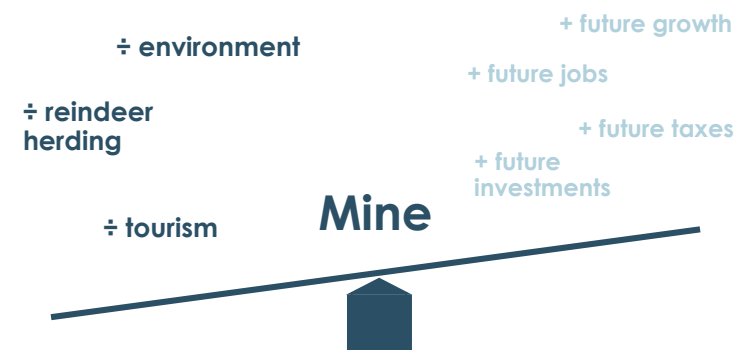
Which elements are to be included in an application?



No timelines

Increased uncertainty after Norra Kärr ruling

How will mining be weighed against other activities and interests?



Source: Copenhagen Economics

BOX: Balancing areas of national interest (riksintressen)

LAND AREAS IN HIGH DEMAND

There are twelve authorities responsible for areas of national interest in Sweden. The interests are of different characteristics, however most of them aim at preservation, infrastructure, extraction, defence or security.

The map to the right show areas that have been 'claimed' by one of the twelve authorities. An area does not formally classify as a national interest until it has been tried in court. As is clear from the map, many claims overlap geographically, sometimes giving rise to conflicts of interests. There are processes in place to handle such conflicts, however, balancing two national interests, or reserved areas, of different kind can be challenging.

The National Board of Housing, Building and Planning, is in charge of coordination among the responsible authorities, and it monitors the application of the national interest scheme.

The scheme is designed to enable dialogue on how and in what way different national interests can be integrated and assessed against other public interests in social planning. In order for the national interest system to work, it is important that areas of interest are clearly defined and have well-developed value descriptions that are adapted to current conditions.

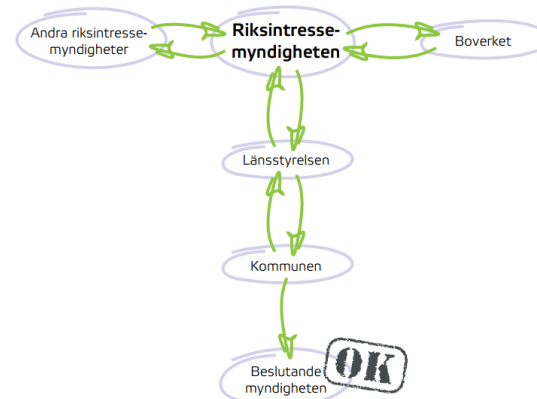
The legal text stipulates that interests related to defence and security should always be prioritized. However, deciding whether a mine should be prioritized over reindeer herding or not is less

straight forward, especially if the two interests or claims are found by one or several parties to be unable to coexist.

The National Board of Housing, Building and Planning offer recommendations to the responsible authorities on how to describe their claims on national interests in order to facilitate comparisons between different types of national interests when conflicts arise.

The Swedish Environmental Protection Agency (Naturvårdsverket), which is responsible for Chapter 6 of the Environmental Code, is currently putting together guidelines on how to balance between different interests. It remains to be seen whether this guide will address also how to assess and include economic benefits from extraction of minerals.

A well established national interest scheme



Source: Boverket (2013) Riksintressen - nationella värden och möjligheter, p. 8

Many overlapping claims



Source: Boverket (2017) Kartor riksintressen <http://www.boverket.se/sv/PBL-kunskapsbanken/Allmant-om-PBL/teman/riksintressen/kartor/>

Decision paralysis

UNCERTAINTY AND RISK OF MAKING A 'WRONG' DECISION RESULT IN NO DECISION

Permits for mines or other large production facilities are likely to have long-lasting effects on the area and community in which they are to be located. Hence, it is only natural that the people making the decision on giving permission or not, seek to gather as much information as possible to enable an informed decision.

Especially if the risk of making a 'wrong' decision is perceived to be high and/or the consequence of doing so is difficult to predict, there is a tendency for regulators and decision makers, not only in Sweden but in general, to request more information from the applicant in the form of reports, forecast etc. to increase the amount of information, with the objective to decrease the amount of unknowns and uncertainty. However, requesting additional information may often not address the root of the problem, namely an inherent uncertainty about what will happen in 10-20 years time.

In other words, uncertainty may result in a state of 'decision paralysis' with the decision makers.

Generally, decision paralysis causes permitting processes to become longer, less predictable and more expensive for the applicant. Especially for listed and risk capital financed companies, it may be a real issue to 1) finance the additional work to bring more information about and 2) manage stakeholders' expectations and reaction without the possibility to provide them with a credible timeline and outlook for permission granting.

When multiple decision makers are involved, decision paralysis in several layers of governments is likely to slow down processes further or even create decision dead locks. Recent examples of this has occurred between the Mining Inspectorate and the county administrative board in Norrbotten.

Deadlock in permitting process

”

Länsstyrelsen kan notera att sedan myndighetens senaste yttrande den 31 januari 2017 är frågan om verksamhetens påverkan på Laponia och dess status som världsarv fortfarande inte är utredd. Länsstyrelsen behöver fortfarande ett komplett underlag gällande verksamhetens påverkan på Laponia och dess status som världsarv innan en slutlig bedömning enligt 3 kap. Miljöbalken kan ske. Detta eftersom länsstyrelsen varken kan eller ska bedöma verksamhetens påverkan på Laponia och dess status som världsarv. Den hanteringen ankommer istället på Riksantikvarieämbetet och Naturvårdsverket i egenskap av nationella världsarvmyndigheter. Länsstyrelsen har efter Bergsstatens remiss den 7 maj 2017, genom dialog med Riksantikvarieämbetet och Naturvårdsverket fått besked att de ej avser att yttra sig till länsstyrelsen in detta skede.

Så länge världsarvfrågan och Laponia inte är utlöst avstår länsstyrelsen från att lämna något ställningstagande och översänder yttrandet till Bergsstaten för fortsatt handläggning.

“

Source: Länsstyrelsen Norrbotten (2017-06-16) Yttrande över Bergsstatens remiss gällande bearbetningskoncession för Kallak K nr. 1 inom Jokkmokks kommun



3 DE-RISKING POLICIES

Policies to reduce technology, market, and institutional risk

Technology risk

1. Signal political priority and support to battery value chain through more focused allocation of innovation funds, topical calls and innovation prizes for a number of years going forward

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Source: Copenhagen Economics based on interviews and own research

1. Signal political priority and focus allocation of innovation funds

SEND A CLEAR POLITICAL SIGNAL

Swedish governmental innovation policy is primarily governed through five strategic collaboration programs (Strategiska Samverkansprogram) with the objective to develop new ways of travelling, doing business, living, communicating and preserving natural resources and natural ecosystems.¹ These strategic focus areas do, however, not point to specific technologies or outcomes that are going to be part of the realisation of these policies in the future. On the one hand, that is sound policy because it reduces the risk of betting public money on the 'wrong' technologies or 'picking the winners'. On the other hand, it means that research policy and innovation support, all else equal, will be less focused and with a broader focus naturally follows less speed in *specific* research and development areas.

Given that global demand for electrification is rising and battery technologies have indeed moved beyond

basic research, and if a Swedish battery production value chain is a political priority, we recommend the central government to define this sector as a political focus area, similar to the area of e.g. Test Beds, which have been named an independent focus, while at the same time falling within the scope of the overall strategic collaboration programs. In addition, a battery innovation program could fit very well with the Swedish effort within electric vehicles.²

MORE FOCUSED INNOVATION CALLS

To promote innovation and research in battery technologies and –production before the window of opportunity closes, dedicated funds should be allotted to projects falling within a relatively narrow focus to ensure speed. There may be a tendency for existing innovation calls in Sweden to be rather broad in scope. However, good examples also exist and could be copied for batteries; for example in May 2017, the Minister of Enterprise and Innovation

commissioned Vinnova to allocate funds through focused calls for research projects within testbeds (Testbäddar inom miljöteknikområdet). It may also be possible through the existing innovation programs of Vinnova, SIP STRIM, SIO Grafen (just to name a few), to (re-)allocate grants and funds for battery focused calls.

Other examples of focused initiatives are research and innovation prizes or competitions. Instead of allocating funds to the best *idea* or *concept for a project*, innovation prizes allocate funds to the *best result* or *solution*. An example of the latter is provided by the Swedish Environmental Protection Agency, who will, for the next year, be hosting a competition between two competing teams with representatives from industry, research institutes and universities to compete in designing a carbon-free building process for a fictitious new Öresund bridge by 2045.

Examples of focused innovation support schemes to induce speed in research^{3,4}

Testbäddar inom miljöteknikområdet – 2017:

Testbäddar inom miljöteknikområdet – hösten 2017

Stängde 7 juni 2017

I det här erbjudandet vänder vi oss till företag och andra organisationer inom miljöteknikområdet. För att få bidrag ska projektet ha potential att etablera en ny eller väsentligt förbättra en befintlig nationell testinfrastruktur. Vi finansierar både planeringsprojekt och fullskaliga projekt (projektering och/eller realisering av en testbädd). Denna utlysning är en del av regeringens satsning Testbädd Sverige.

PRESSMEDDELANDE 2017-06-07

Ny innovationstävling ska minska industriutsläpp

Hur kan en ny Öresundsbro byggas utan växthusgasutsläpp? Svaret på frågan ska arbetas fram i en unik innovationstävling. Tävlingen kommer att bidra till kraftigt minskade utsläpp av växthusgaser från industrin och är resultatet av ett nytt samarbete mellan myndigheter, näringsliv och forskning.

Source: 1) Näringsdepartementet (2016) Faktablad - Regeringens strategiska samverkansprogram, 2) Regeringen (Maj 2017); Nationell satsning på elektriska fordon, <http://www.regeringen.se/pressmeddelanden/2017/05/nationell-satsning-pa-elektriska-fordon/>, 3) <https://www.vinnova.se/e/testbaddar-inom-miljoteknikomradet-2017/>, 4) <http://www.naturvardsverket.se/Nyheter-och-pressmeddelanden/Ny-innovationstavling-ska-minska-industriutslapp>

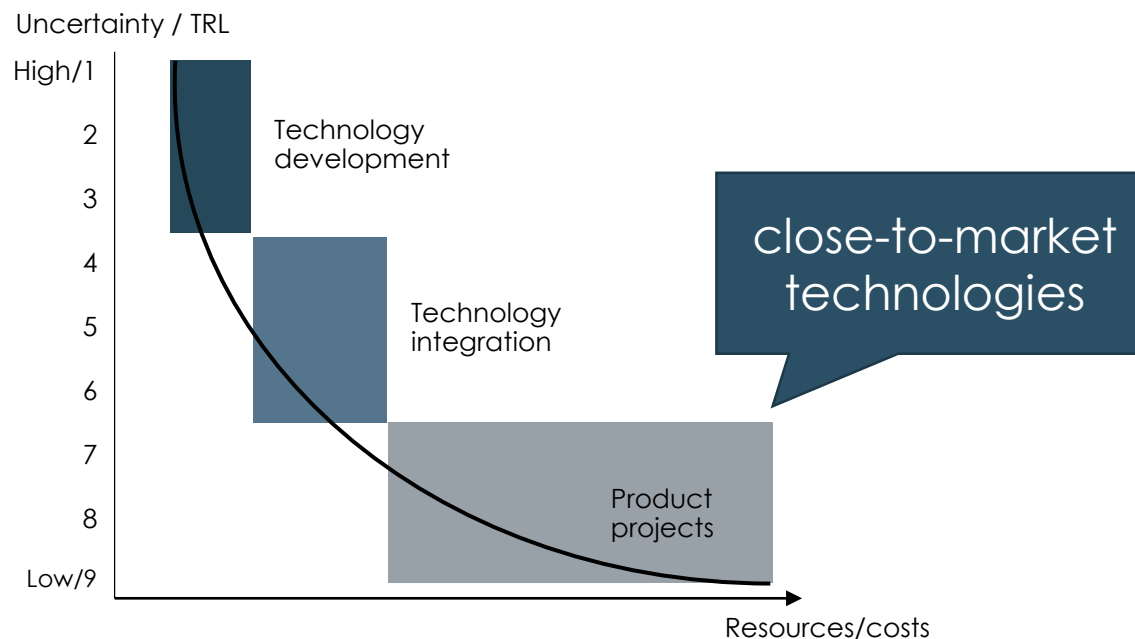
2. Fund pilot- and test facilities

BRING INNOVATIONS CLOSER TO COMMERCIALIZATION BY REDUCING COSTS

Innovations that are, in principle, close to commercialization can still be subject to considerable risk and hence be difficult to finance and get off the ground. Solving issues with manufacturing, turning prototypes into scale production, reducing costs to make the product or service competitive etc., can often be a constraint and stakes, in terms of resources, are often very high this far into the project. Therefore, we recommend to allocate funds to support pilot- and test facilities where close-to-market technologies can be tested and finally commercialized in Sweden.

As research at this technology level is often expensive and because other European countries have comparative advantages in similar technologies, we also recommend that Sweden push for similar programs in a European context to ensure a sufficient level of funds and knowledge dispersion.

Provide funding also for higher Technology Readiness levels (TRLs)



Source: RISE (2016): *Så jobbar RISE med TRL*; <https://www.ri.se/nyheter/film-sa-jobbar-rise-med-trl-technology-readiness-level>

Targeted research for all technology levels

TRL 1	TRL 2	TRL 3	TRL 4	TRL 5	TRL 6	TRL 7	TRL 8	TRL 9
• Basic research: basic principles observed	• Technology concept formulation: concept and application have been formulated	• Applied research: first laboratory tests completed, experimental proof of concept	• Small scale prototype: technology validated in lab	• Large scale prototype: Technology validated in relevant environment	• Prototype system: Technology demonstrated in relevant environment	• Demonstration of prototype system: operating in operational environment at pre-commercial scale	• First of a kind commercial system: System complete and qualified, manufacturing issues solved	• Full commercial application: actual system proven in operational environment, technology available for consumers

Source: European Commission (2014) *Horizon 2020 Work Programme 2014-2015 General Annexes, G. Technology readiness level (TRL)* http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

3. Focused and open clusters and networks

ENSURE A COMMERCIAL FOCUS

Successful clusters such as Silicon Valley, Hollywood, and the iron and steel cluster in Sweden have all grown from a commercial interest from the involved businesses. The commercial interest and opportunity is the key driver behind them.

Network meetings organised and driven by public institutions will often lack that key driver and are therefore not likely to be self-sustainable. It is therefore critical that Swedish cluster policies are build around the commercial reason for companies to join and remain engaged.

We recommend to offer a well-focused and time limited grant for industry organisations or joint-

ventures of such to facilitate network activities for a period of time, with the clear requirement that it be closely tied to industry rather than academia.

If the commercial interest is sufficiently strong, the network will gradually evolve to an actual cluster, also after the time limited funding has come to an end.

MAKE IT EASY TO PARTAKE

A low-hanging fruit would be for existing networks to make sure that everybody, also non-Swedish speakers, can participate. That would allow for experience and knowledge to disperse even wider.

As of today, there are several fora for research and

development that could be relevant for a graphite-for batteries value chain, but not all are equally accessible for foreigners. Prospekteringsrådet, organised by SGU, is held in Swedish, making it difficult for foreign companies to take part. Other organisations have recently picked up on the value of making their material more available. For example, as of April this year, Georange’s monthly newsletter is available in both Swedish and English.

Examples of existing networks in Sweden

The screenshot shows an invitation from SGU (Sveriges geologiska undersökning / Geological Survey of Sweden) for a meeting on April 4, 2017. The text is in Swedish. A blue callout box points to the title of the meeting.

Invitation to Prospekteringsrådet in Swedish

The image shows two versions of the Georange newsletter for April 2017. The top version is in Swedish, titled 'VÅRENS AKTIVITETER'. The bottom version is in English, titled 'SPRING ACTIVITIES'. A blue callout box points to the English version.

Georange adapting to an industry with international players

Source: www.sgu.se and www.georange.se

4. Introduce certification

CREATE A MARKET FOR ‘LOW-IMPACT PRODUCTS’

To create and support a future market for Swedish produced ‘clean’ or ‘low-impact’ produced green tech products, we recommend to develop criteria for and introduce a certification for metals, minerals and derived products that are compliant with Swedish goals for socially and environmentally sustainability. There may, however, not yet be a willingness to pay a price premium on goods produced from metals that are certified non-conflict and clean/low-impact, but like other products, e.g. ecological products, this *could* be a matter of lacking supply and awareness.

Currently, to the best of our knowledge, no successful certification scheme has been developed for industrial metals, but other raw materials such as wood or seafood have sustainability certificates and the Swedish national accreditation body, SWEDAC, is responsible for trade in and the production of articles made from precious metals in Sweden. Therefore, we believe that Sweden can take a world-leading position in developing and introducing a sustainability code and certificate for minerals/metals and promote it to Europe and the rest of the World.

Criteria for earning the certificate could depart from existing TSM-requirements in the industry to ensure anchorage, but preferably with a more strict and Swedish twist, building on an existing strong environmental profile. SWEDAC could be the responsible authority for future accreditation and supervision.

Examples of certifications

	<p>Production methods</p> <p>Environment</p> <p>Animal welfare</p> <p>(Social responsibility)</p>	 <p>Low impact products through entire life cycle</p>
	<p>Sustainable production methods</p> <p>Social responsibility</p> <p>Traceability</p>	 <p>Purity</p> <p>Quality</p> <p>Traceability</p>

Source: Copenhagen Economics' own research

5. Feed-in support to companies adhering to certification

SUPPORT INDUSTRY IN ADOPTING PRODUCTION METHODS IN LINE WITH CERTIFICATION

Converting production from conventional to certified production can be difficult and expensive. In addition, producers may not in the very short run be able to pass on the additional production costs to the customers because the willingness to pay is too low, or because costs have to be further reduced. This would be similar to the introduction of bio-foods in supermarkets some 25 years ago; the products were significantly more expensive than conventional products, consumers were not fully aware of them, and choice was limited. Today it is indeed a different story.

To reduce the introduction period and the creation of supply *and* demand for low-impact metals/minerals and their value added products, we recommend to introduce financial feed-in support for existing and new firms in Sweden who wish to adhere to the standard and earn the certificate. Preferably, Sweden should push for similar initiatives within the EU as well.

The Danish government supporting organic farming

Blå partier er klar med 310 mio. kroner til mere økologi

Flere end 1.000 landmænd har i år søgt om støtte til at omlægge til økologi eller udvide den økologiske produktion. Regeringen er sammen med Dansk Folkeparti, Liberal Alliance og Konservative klar med op til 310 mio. kroner, så alle landmænd, der opfylder betingelserne, kan få støtte.

Publiceret 16. juni 2016

Danske landmænd står i kø for at omlægge til økologi

16. jun. 2016, 07:50 Opd. 16. jun. 2016, 09:20



1.028 landmænd har i år søgt om støtte til at omlægge til økologi eller udvide deres økologiske areal.
Foto: Morten Dueholm / Scanpix Denmark

af Ritzau

Ikke siden slutningen af 1990'erne har så mange danske landmænd ville drive økologisk landbrug.

Source: Miljø- og Fødevarerministeriet (2016) *Blå partier er klar med 310 mio. kroner til mere økologi* <http://mfvm.dk/nyheder/nyhed/nyhed/blaa-partier-er-klar-med-310-mio-kroner-til-mere-oekologi/>, TV2 (2016) *Danske landmænd står i kø for at omlægge til økolog* <http://nyheder.tv2.dk/business/2016-06-16-danske-landmaend-star-i-ko-for-at-omlaegge-til-okologi>

6. Introduce TSM-like governance structure

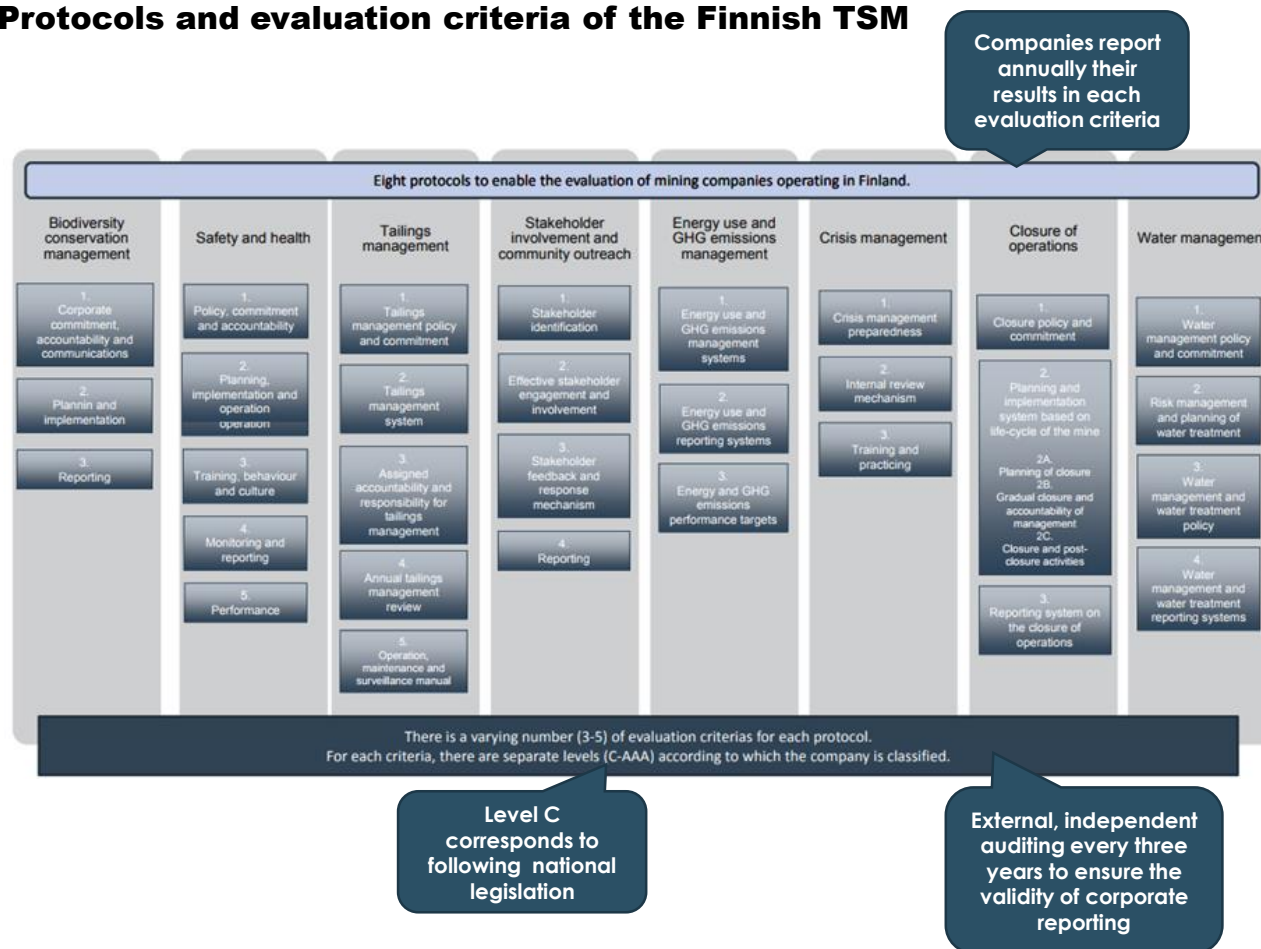
MORE DYNAMIC REPORTING

Sweden is suffering from vastly deteriorating international reputation in the mining community due to an (perceived) increase in institutional risk illustrated by an (increasingly) unpredictable permitting process and decision paralysis. We believe part of the reason for the decision paralysis to be uncertainty and insecurity with authorities regarding future outcomes, causing them to prefer a full-control, but non-decision outcome to an outcome with a potential ‘wrong decision’.

To reduce the authorities’ risk from giving up control, we recommend to introduce a dynamic governance structure, similar to the Canadian, and later adopted by the Finnish mining industry, Towards Sustainable Mining (TSM) industry code. To comply with the code, mining companies must commit to produce to a certain environmental and social standard and continuously report on their compliance and performance. By knowing that companies will be in compliance with these requirements (often stricter than legislation) and publicly report on their compliance going forward, it may take the edge of the existing pressure lying on civil servants. Government, in the form of SGU, could work to promote the adoption of the initiative, but it should be driven by the industry itself, i.e. Svemin or another organisation.

According to mining organisations in both Canada and Finland, adoption of the TSM code has also helped the public image (so-called social license to operate) of the industry amongst the general public.

Protocols and evaluation criteria of the Finnish TSM



Source: Finnish Network for Sustainable Mining, Presentation for the International Raw Materials Materials Conference, Berlin, 10 -11 November 2015

BOX: TSM in Canada and Finland

Canada – the birthplace of TSM

In the early 1990s, Canadian mining companies suffered from a series of high-profile tailings dam failures, leading to massive negative media attention. From this several challenges arose, and mining projects had to be cancelled due to public controversy. In particular, the members of The Mining Association of Canada (MAC) began to understand the need for improved performance and better risk management

With this in mind, MAC launched the Whitehorse Mining Initiative. The aim was to improve the mining industry's reputation through acknowledging the importance of environmental and social sustainability and communication with the public. Following this initial initiative, several others were carried out and in 2004 MAC established Towards Sustainable Mining (TSM).

The TSM Guiding Principles are outlined in the following paragraph, explaining the core objective of TSM.

As members of the Mining Association of Canada, our role is to responsibly meet society's needs for minerals, metals and energy products. To achieve this, we engage in the exploration, discovery, development, production, distribution and recycling of these products. We believe that our opportunities to contribute to and thrive in the economies in which we operate must be earned through a demonstrated commitment to sustainable development.

Accordingly, our actions must demonstrate a responsible approach to social, economic and environmental performance that is aligned with the evolving priorities of our communities of interest. Our actions must reflect a broad spectrum of values that we share with our employees and communities of interest, including honesty, transparency and integrity. And they must underscore our ongoing efforts to protect our employees, communities, customers and the natural environment.

Source: The Mining Association of Canada (2014) Towards Sustainable Mining 101: A Primer

Finland – one of many adapting to TSM standards

Finland experienced a mining boom during early 2000s, and had troubles coping with the young industry. There were conflicts over land-use, challenges related to investments and financing and rather negative opinion towards non-domestic companies. Combined with volatile commodity prices and high energy taxation, this hampered development of the Finish mining industry.

To get on the right track a new mining law was introduced in 2011, and in the aftermath of a tailings accident in October 2012 a process involving multiple stakeholders was initiated by the Ministry of Employment and the Economy and the Ministry of the Environment. The aim was to make Finland a leader in the sustainable extractive industry.

The Finnish TSM standard consists of eight protocols with clear criteria enabling progress of mining companies operating in Finland. The protocols cover topics such as safety and health, closure of operations and tailings management.

Companies are individually evaluated based on their performance in each protocol. The overall result is presented as a rank. A rank of C is equivalent of complying with national legislation. The goal is for all companies to achieve a rank of A, to ensure the sustainability of operations.

Source: Presentation by Mr. Eero Yrjö-Koskinen, Chairman of the Finnish Network for Sustainable Mining at the 24th OSCE Economic and Environmental Forum (26 January 2016)

7. Include positives of mining into balancing of conflicting interests

A MORE NUANCED ASSESSMENT OF CONFLICTING INTERESTS

We find that there is a need to more formally include the positives and benefits of mining into the balancing of mining against other conflicting land uses. Hence, we recommend the National Board of Housing, Building and Planning and the Mining Inspectorate to include into the formal assessment of mining projects the potential economic upsides on equal footing with the negatives as described in the EIA, Heritage studies etc. Companies are responsible for conducting the assessment and authorities are responsible for employing right-skilled people to assess the results.

To prevent the economic impact assessments to become a static document with little focus on actual value creating as has been seen in other jurisdictions, we recommend to couple assessments with (binding) plans for realisation of the estimated benefits. Such a plan could for instance include suggestions for collaboration between company, municipality, and other stakeholders to address local challenges to realise mutually beneficial results.

Socio-economic impact assessment and realisation plan to complement the EIA?

Miljökonsekvensbeskrivningar och miljökonsekvensbedömningar av verksamheter och åtgärder

3 § Syftet med en miljökonsekvensbeskrivning för en verksamhet eller åtgärd är att identifiera och beskriva de direkta och indirekta effekter som den planerade verksamheten eller åtgärden kan medföra dels på människor, djur, växter, mark, vatten, luft, klimat, landskap och kulturmiljö, dels på hushållningen med mark, vatten och den fysiska miljön i övrigt, dels på annan hushållning med material, råvaror och energi. Vidare är syftet att möjliggöra en samlad bedömning av dessa effekter på människors hälsa och miljön.

CE suggestion for operationalisation

Samhällsekonomisk konsekvensbeskrivning

X § Syftet med en samhällsekonomisk konsekvensbeskrivning för en verksamhet eller åtgärd är att identifiera och beskriva de direkta och indirekta ekonomiska effekter som den planerade verksamheten eller åtgärden kan medföra på samhället och människorna, dels i närområdet, men även på regional- och nationell nivå. Vidare är syftet att möjliggöra en samlad bedömning av dessa effekter på samhället.

Y § Den samhällsekonomiska konsekvensbeskrivningen måste kompletteras med en gällande plan för realisering av samhällsekonomiskt värde som ska upprättas av verksamheten. Verksamheten ska i planen redogöra för hur de ska verka för att uppnå de samhällsekonomiska vinster som beskrivits i den samhällsekonomiska konsekvensbeskrivningen.

Source: Regeringskansliet, Miljöbalk (1998:808) and Copenhagen Economics

8. Predictability in permitting

PROVIDE BETTER GUIDANCE

To increase transparency and predictability in permitting, we recommend to develop and publish guidelines and checklist for a complete application. Specific guidelines for each report in the application could also be helpful for the applicant. Authorities should reserve the right to ask for additions and addendums.

Guidelines and checklists would make it easier for applicants to provide complete applications quicker because they know what is expected from them, but also for the Mining Inspectorate as it ensures greater consistency and homogeneity in the received applications. Hence, applications should become easier to assess.

INTRODUCE TARGET TIMELINES

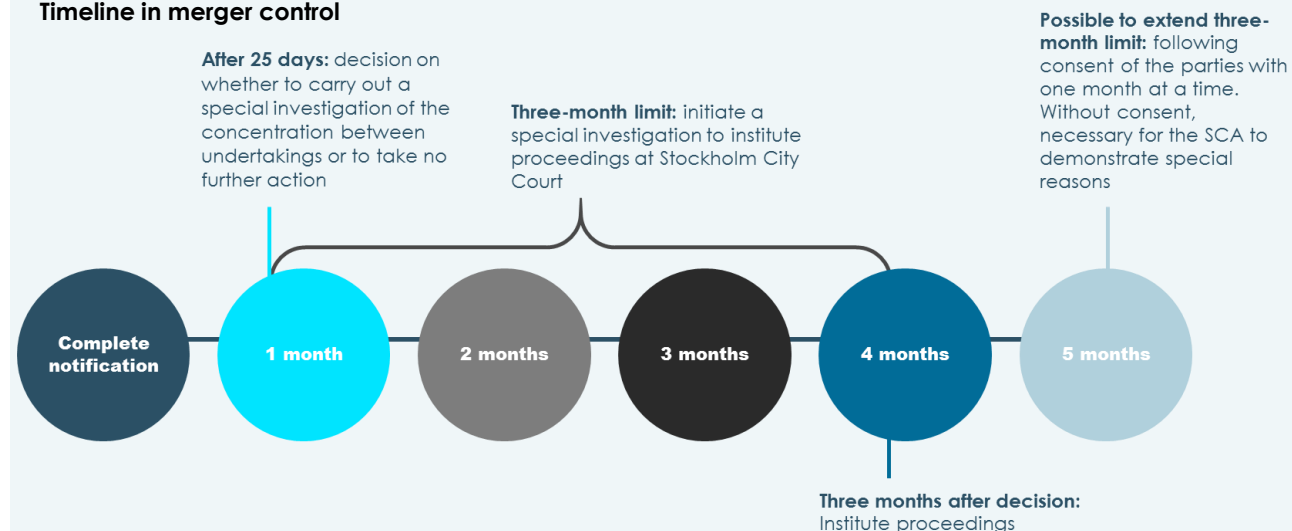
We also recommend to introduce target timeline for authorities' direct response time to applicants plus inter-governmental response timelines. At the very least, provide guidance as to *expected* approval time within each step.

Introducing target timelines may seem like a big step, but within the area of merger control, competition authorities actually operate with *binding timelines*. The reason is that mergers are time sensitive transactions and subject to a limited window in which they are deemed by stakeholders to be commercially relevant. The same can probably be argued for mining applications, where market prices, stock prices and commercial opportunities may very well change quickly. More predictability with respect to approval time will reduce this risk and the pressure on applicants.

Example: Timelines in permitting procedures

Merger control, handled by the Swedish Competition Authority (SCA), is one example of government administration where timelines apply. When two larger companies decide to merge they notify the SCA, and when the notification is found to be complete according to the official requirements, the clock starts ticking. The first deadline for the SCA is 25 working days after the complete notification has been received (Phase 1). At this point the SCA either decides to carry out a special investigation of the concentration between companies or to take no further action. If they decide to continue their investigation (enter into Phase 2), a final decision must be made within three months, unless the 3 month limit is extended by the Stockholm City Court.

Timeline in merger control



Timelines in other parts of public administration?

The Parliamentary Committee on Industry and Trade has identified long approval times as a competitive barrier and a bottleneck for companies who wish to establish themselves and grow in Sweden. For this reason, the Committee in March 2017 argued that the government must ensure that authorities set clear timelines.

Source: *Guidance from the Swedish Competition Authority for the notification and examination of concentrations between undertakings (2015)*, p. 9, *Sveriges Riksdag (2017) Aktuellt: Myndigheter bör ha tydliga tidsgränser för handläggningstider* <http://www.riksdagen.se/sv/aktuellt/2017/mar/16/myndigheter-bor-ha-tydliga-tidsgranser-for-handlaggningstider/>

BOX: Applying for a mining lease in Western Australia

A DETAILED AND USER-ORIENTED ONLINE PLATFORM

Western Australia (WA) is one of the most prominent mining jurisdictions and has done a lot of work to professionalise and ease the procedures for handling applications for mining concessions (or leases as they are called in WA).

Compared to the webpage of the Swedish Mining Inspectorate, the Department of Mines, Industry Regulation and Safety offers more guidance for the applicants through checklists and guidelines for filling out the necessary and required documentation. It helps not only applicants to do an easier job on their applications, it also ensures more efficient procedures for the civil servants assessing the applications. Furthermore, applications, environmental impact assessments and compliance reporting are launched and tracked via an online system.¹

The WA regulator also works with a set of target timeline for the approval process. Target deadlines varies between 30 and a max of 120 business days, depending on the type of application and mineral/metal. The 120 day-limit are for petroleum exploration permits only. The approval time measures only the days where the regulator is processing the application material and 'the clock is stopped' whenever the next step is the applicant's.²

Department of Mines, Industry Regulation and Safety's online platform³

The screenshot displays the website's navigation menu with 'Environment' selected. The 'How do I' section is open, showing a list of steps for 'Mining lease':

- Step 1. Check ground availability - Mining Lease
- Step 2. Marking out a tenement - Mining Lease
- Step 3. Lodge application with the department - Mining Lease
- Step 4. Serving of notices
- Step 5. Documents required to be lodged before a mining tenement is granted - Mining Lease

The 'Step 5' page is highlighted, showing the title 'Step 5. Documents required to be lodged before a mining tenement is granted - Mining Lease'. The page content includes:

Documents required to be lodged before a mining lease may be granted

A [Form 32](#) security in the sum of \$5000 must be lodged in respect to all applications within 28 days of the application being made - [Sec 126](#) and Reg 112.

Pursuant to section [74\(1\)\(ca\)](#) mining lease applications must be accompanied by one of the following three types of documentation:

- a [Mining Proposal](#) under Section 74(1)(ca)(i) within 14 days — see [guidelines for submitting a Mining Proposal](#)
- a statement about likely mining operations ('[Supporting Statement](#)'), and a [Mineralisation Report](#) under Section 74(1)(ca)(ii) — see [guidelines for Mineralisation Report and Supporting Statement for a Mining Lease Application](#).
- a statement about likely mining operations ('[Supporting Statement](#)'), and a [Resource Report](#) under Section 74(1)(ca)(iii) — see [guidelines for submitting a Resource Report](#).

Note: A statement of mining operations shall set out information regarding the mining operation likely to be carried out including:

- when mining is likely to commence
- the most likely method of mining
- the location, and the area of the land that is likely to be required for the operation of the plant, machinery and equipment and for the other activities associated with those mining operations.

For more information on these three types of documents click [here](#).

Source: 1) <http://www.dmp.wa.gov.au/Minerals/How-do-I-Minerals-8044.aspx>

2) <http://www.dmp.wa.gov.au/Investors/Approvals-14055.aspx>, 3) <http://www.dmp.wa.gov.au/Index.aspx>

CRITICAL METAL VALUE CHAINS

Deep dive into barriers and policies

AUTHORS

Christian Jervelund

Signe Rølmer

Sofia Nyström

Partner

Senior Economist

Economist

Appendix
Interviews

Name	Title	Workplace	Department
Berggård, David	Environmental Engineer	Country Administrative Board of Norrbotten	Environmental Unit
Björefors, Fredrik	Researcher and Senior Lecturer	Uppsala University	Ångström Laboratory, Department of Chemistry
Gylesjö, Susanne	Administrator	Vinnova	Industrial Development
Ingvald, Erika	Head of Division	SGU	Mineral information and Mining Industry
Karlsson, Peter	CEO	Northvolt	
Lax, Kaj	Department Manager	SGU	Mineral Resource
McManus, Jeremy	Commercial Manager	Talga Resources	
Samuelsson, Ann-Christin	Acting Department Manager	Kiruna Municipality	Business Development, Development and Establishment
Segerlund, Lena	Investment Manager	Invest in Norrbotten	
Theander, Helena	Director SIO Graphene	Chalmers	CITR, SIO Grafen
Thompson, Mark	Managing Director	Talga Resources	
Weihed, Pär	Directly Appointed Professor	Uppsala University	Department of Engineering Sciences
Öhman, Maria	Administrator	Vinnova	Industrial Development