

OECD Rural Studies

Mining Regions and Cities Case of Västerbotten and Norrbotten, Sweden



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Foreword

The mining sector is relevant for the economic development and well-being of countries and regions. Raw materials are essential for the production of goods and services and the development of new technologies. They can also play an important role in the global transition towards a zero-carbon economy. The subnational dimension is critical to delivering better policies for economies specialised in mining activities. Unlike other industries, mining is geographically concentrated in those areas where the deposits lie, creating particular interactions with local communities and the environment. Mining specialisation generates a number of opportunities, including greater investments, technological innovation and higher-wage jobs. Yet, it also brings challenges, including vulnerability to external shocks, and environmental and social impacts. These positive and negative impacts are amplified at regional and local scales.

Sweden's northern region, Upper Norrland, is one of the most important mining regions in Europe and has the potential to become a global leader in environmentally sustainable mining. With the largest land surface and the lowest population density in Sweden, Upper Norrland contains two sub-regions, Västerbotten and Norrbotten. Both sub-regions host the largest mineral reserves in the country, containing 9 of the country's 12 active mines and providing 90% of the iron ore in the European Union (EU). Amongst the two, Västerbotten is more densely populated and has a more diversified economy, while Norrbotten is larger in terms of land surface and more specialised in mining, concentrating most of the active mines and production volumes in Sweden.

Upper Norrland has the potential to become a global leader in environmentally sustainable mining due to its competitive advantages. These include a pool of large mining companies working closely with research centres and universities to reduce the emission footprint and waste production across the mining value chain, together with a highly skilled labour force to drive innovation. The region also has a stable supply of green energy from hydropower and high-quality broadband coverage. Fully unlocking this potential will contribute to global climate agendas and the EU's self-sufficiency strategy of raw materials.

Yet, the region must overcome a number of bottlenecks to support a sustainable future. They include a shrinking workforce, low interaction of municipalities and small businesses with the mining innovation process, lack of preparation of the workforce for future technological changes, as well as increasing opposition to mining due to socio-environmental concerns and land use conflicts.

This study identifies how Västerbotten and Norrbotten can build on their competitive advantages and address current and future challenges to support a resilient future through sustainable mining. To this end, Sweden's national government needs to update the national mining strategy, define mechanisms to help the region capture greater value from mining ventures and improve the efficiency, predictability and transparency of the regulatory framework for mining. Both sub-regions need to enhance their innovation ecosystem, the local business environment, and internal and external co-operation.

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Abbreviations and acronyms

CAB	County Administrative Board
CAMM	Centre for Advanced Mining and Metallurgy
CRMs	Critical Raw Materials
EA	Environmental Assessment
EARDF	European Agricultural Fund for Regional Development
EC	European Commission
EIA	Environmental Impact Assessment
EIP	European Innovation Partnership
ERDF	European Regional Development Fund
ESF	European Social Fund
ESIF	European Structural and Investment Funds
FNDR	National Fund for Regional Development
FUA	Functional Urban Area
GDP	Gross Domestic Product
GTK	Geological Survey of Finland
GVA	Gross Value Added
GVC	Global Value Chain
HSEC	Health, Safety, Environment and Community
ICT	Information and Communication Technology
LLM	Local Labour Market

MIREU	Mining and Metallurgy Regions of EU
NGO	Non-Governmental Organisation
NM-S	Non-Metropolitan Region with access or near a small city
NRM-M	Non-Metropolitan Region near a city
NSPA	Northern Sparsely Populated Areas
PPI	Policy Perception Index
PPP	Purchasing Power Parity
RBP	Renbruksplaner [Reindeer Husbandry Plans]
REE	Rare Earth Elements
REMIX	Smart and Green Mining Regions
RIA	Regional Impact Analysis
RTP	Regional Technology Plan
SEK	Swedish Krona
SGR	General System of Royalties
SGU	Geological Survey of Sweden
SIA	Social Impact Assessments
SIP	Strategic Innovation Program
SNA	System of National Accounts
STI	Science and Technology-based Innovation
STRIM	Swedish Mining and Metal-producing Industry Programme
SUM	Sustainable Underground Mining
TIVA	Trade in Value Added
TL2	Territorial Level 2
TL3	Territorial Level 3
VET	Vocational Education and Training

Executive summary

Assessment

Upper Norrland is a key mining region, both at the national and European levels, and has a number of competitive advantages to become a global leader in environmentally sustainable mining. It is Sweden's most northern region, concentrating 9 out of 12 active mines and providing 90% of the iron ore produced in Europe. Upper Norrland includes two sub-regions at Territorial Level 3 (TL3), Västerbotten and Norrbotten. The former is more densely populated (4.8 inhabitants per km² against 2.6 in Norrbotten) and has a more diversified economy, while Norrbotten is larger (covering 64% of Upper Norrland) and more specialised in mining. The study confirms a number of competitive advantages in Upper Norrland. They include a strong innovation ecosystem with companies at the frontier of environmentally sustainable mining, working closely with research centres and universities, a highly skilled labour force (36% with tertiary education), reliable and green energy infrastructure and high broadband coverage (99% of households connected to broadband).

Upper Norrland can play a key role in the EU's self-sufficiency strategy of raw materials and global environmental agendas while raising national and regional well-being. The region's bedrock has a high potential of rare minerals, which are needed for the clean energy transition, and concentrates the largest, non-exploited mineral reserves in the country. Upper Norrland's mining ecosystem is well placed to meet increasing global demand for high environmental standards in mining operations, as well as for unlocking new opportunities for regional economic development and attractiveness. To this end, Sweden's policy framework goes in the right direction, by promoting innovation in the mining sector as a vehicle to boost economic growth and accelerate the transition towards a zero-carbon economy.

However, the region must also overcome various bottlenecks to enhance well-being and attain sustainable regional development linked to mining. The region struggles with a shrinking workforce driven by youth outmigration (especially women) and low retention of migrants, a low interaction of municipalities and small businesses with the innovation process of large firms and universities, and low entrepreneurship culture. Furthermore, regional development objectives are not sufficiently linked to land use planning and there is a need to improve training programmes to prepare the workforce for future technological changes and better include young people, especially women, in value-added activities (i.e. in mining and the service sector).

At the national level, the policy framework lacks a strong regional lens and a coherent vision of how mining development can create regional well-being. Sweden's mineral strategy expires in 2020 and could benefit from greater clarity on the instruments that can mobilise the potential of the local mining ecosystem and implement value creation mechanisms for local communities. Furthermore, the study finds that Sweden's regulatory framework for mining permits is complex and would benefit from reducing delays, as well as uncertainty on the scope of permit applications. The regulatory framework can also better integrate socio-economic and cultural aspects as well as combined impacts of past, present and future activities of mining into decision-making. Finally, the dialogue and consultation processes for mining development, especially in relation to the Sami people, can further improve trust in the system.

Key recommendations

Becoming a global leader in environmentally sustainable mining

I. Strengthen and update Sweden's policy framework to become a lead country in sustainable mining practices and technologies. For this, the national government should:

- Define a long-term vision to clarify the role of mining for regional development and support environmentally sustainable mining within Sweden's national policy framework.
- Update Sweden's Mineral Strategy to incorporate local strategies around mining.
- Identify mechanisms to help mining regions capture greater value from ongoing and planned mining ventures.
- Strengthen the brand name of Sweden's mining ecosystem to consolidate it internationally as a "sustainable mining" trademark.

II. Enhance the innovation ecosystem in Upper Norrland to become a global leader in environmentally sustainable mining. For this, the regional councils of Västerbotten and Norrbotten should:

- Strengthen the integration of municipal governments in the innovation process of universities and mining.
- Enhance the entrepreneurship culture and innovation capacity of mining suppliers and small- and medium-sized enterprises (SMEs).
- Reinforce the implementation of the smart specialisation strategies by developing an institutionalised platform for dialogue.

III. Foment internal and external co-operation to consolidate Upper Norrland's vision of development and support global environmental agendas. For this, both regional councils should:

- Define a common vision and brand for mining development in Västerbotten and Norrbotten.
- Co-ordinate Västerbotten's and Norrbotten's regional development strategies to develop and internationalise technologies and practices for a carbon-free mining value chain.
- Take a leading role in EU mining networks and Arctic co-operation to promote the benefits of carbon-free mining value chains for global environmental agendas.

Improving framework conditions for mining and sustainable regional development

IV. Strengthen the local business environment to make the most of mining and attain a resilient future for the region. For this, both regional councils and municipal governments should:

- Develop an institutional body to promote and oversee co-operation among Upper Norrland's municipalities.
- Accelerate the attraction and integration of skilled migrants through better collaboration among municipalities and other regional actors.
- Improve training and education programmes to prepare the workforce for technological changes and further include women in value-added mining activities.

V. Improve Sweden's regulatory framework for mining to better reflect regional development opportunities and increase predictability. For this, the national government should:

- Adopt instruments to improve predictability by introducing set timelines, limits for decision-making, intermediate steps and windows for dialogue at the onset of an application process.

- Strengthen the incorporation of socio-economic, cultural and cumulative impacts in decision-making for mining concessions and environmental permits.

VI. Increase legitimacy and transparency of mining and permit processes through more developed and inclusive mechanisms of dialogue and consultation with all local actors, including Sami people. For this, the national government should:

- Develop clear and consistent guidelines for the mining industry to define how the consultation process should proceed and who should be involved in it.
- Ensure early-stage engagement and consultation rules within the framework of the Minerals Act and Environmental Code.
- Strengthen the capacity of rights holders and interested parties for engagement, including of Sami villages.

VII. Better linking regional development with land-use planning. For this, regional councils should:

- Create an effective co-ordination mechanism that allows for strategic dialogue about land use and economic development between municipalities and the regional councils.
- Develop a platform for resource development to facilitate regional and sustainability-based planning for mines and natural resource projects together with other actors.

1 Assessment and recommendations

Assessment

Upper Norrland is the key mining region in Sweden and has the potential to become a global leader in environmentally sustainable mining

Upper Norrland, Sweden's northernmost and least dense region, is a key mining region at the national and European levels

Upper Norrland is the largest Swedish Territorial Level 2 (TL2) region in terms of land area and concentrates 5% of Sweden's population, which makes it the least densely populated region in the country (3.4 inhabitants per square kilometre). Upper Norrland includes two TL3 regions (Västerbotten and Norrbotten). Amongst the two, Västerbotten is more densely populated (4.8 inhabitants per square kilometre) and hosts the largest city in the region (Umeå), home to 24% of Upper Norrland's population. Norrbotten, in turn, is larger in land area (64% of Upper Norrland) and concentrates most of the active mines and largest production volumes in Sweden. Upper Norrland has the third-highest level of gross domestic product (GDP) per capita across the 8 TL2 regions in Sweden and a lower unemployment rate (5.1%) than Sweden (6.9%) and 40 TL2 OECD mining regions (7.3%).

Upper Norrland concentrates 9 of the 12 active mines in Sweden and provides 90% of the iron ore, 39% of the lead, 37% of the zinc and 24% of the gold production in the European Union (EU). This makes it a key mining region at the national and European levels. Upper Norrland has the largest underground iron ore mine in the world (in Kiruna) and Europe's largest copper mine (in Gällivare). Norrbotten hosts five mines extracting mainly iron ore and copper, which are located in northern municipalities of Gällivare, Kiruna and Pajala. In the case of Västerbotten, most of the mines produce lead, gold, copper and zinc and are concentrated in the municipalities of Lycksele and Skellefteå. Mining is a relevant driver for growth in Upper Norrland, providing 19% of regional GDP. The state-owned company LKAB and the private company Boliden are leading Upper Norrland's mining operation and production.

Upper Norrland has currently a number of competitive advantages to become a global leader on environmentally sustainable mining

Upper Norrland benefits from a number of assets to support mining development and unlock new growth opportunities. It includes a pool of mining and metallurgic companies at the technological frontier of environmentally sustainable mining, working in close collaboration with universities and research centres to increase energy efficiency and establish a carbon-free mining value chain. This innovative environment is coupled with a relatively highly skilled labour force (35.7% with tertiary education in 2017), which is above the average level in OECD TL2 benchmark of mining regions (34.5%).

Upper Norrland's strategic geographic location in the Arctic Circle also offers a large variety of natural ecosystems and biodiversity, positioning the region at the frontline of global environmental agendas. The region's bedrock has a high potential of rare minerals, which are needed to support the clean energy

transition, and concentrates the largest mineral reserves and non-exploited sites in the country. Upper Norrland benefits from reliable green energy infrastructure, providing 21% of the energy in Sweden, mainly from hydropower. The region also has a high broadband coverage recording a higher share of households connected to broadband (99% in 2019) than the average European TL2 regions (98% on average in 2019) and 40 comparable OECD TL2 mining regions (70%).

Drawing on Upper Norrland's assets, Sweden can play a key role in global environmental agendas and the EU strategy of raw materials

Sweden's policy framework puts a strong emphasis on innovation in mining as a vehicle to boost economic growth and accelerate the transition towards a zero-carbon economy

Sweden's Mineral Strategy, the National Strategy for Sustainable Regional Growth and the Swedish Innovation Strategy, provide guidelines for the sustainable development of the Swedish mining ecosystem. Sweden's policy strategies point in the right direction by supporting a close interaction among innovation, mining development and environmentally sustainable policies. This strategic vision has enabled the implementation of a number of cross-sectorial initiatives on mining innovation to minimise residual products and the environmental footprint of mining operations (e.g. projects associated to the Strategic Innovation Programme for the Swedish Mining and Metal Producing Industry).

Yet, Sweden needs to update its national mining strategy with a regional perspective and to improve the efficiency, predictability and transparency of its regulatory framework for mining

The national policy framework lacks clarity on the role of mining in the future development of Swedish regions and a long-term vision to unlock the innovative potential of local mining ecosystems. Sweden's Mineral Strategy expires in 2020. The update will need to better integrate regional strategies on mining development and support SMEs and suppliers involved in the mining value chain. Becoming a powerhouse in sustainable mining requires a clear communication strategy to attract local and international actors. Sweden can improve its current information platforms on mining by creating a unified voice that promotes its assets for carbon-free mining value chains and includes particularities of its local mining clusters.

A revised mining strategy in Sweden needs also to outline a set of measures to help improve how mining regions and municipalities benefit from mining activities and ensure shared value creation. Increased concerns for the negative environmental effects of mining activities, combined with the perception that automation can displace or reduce local employment opportunities, have led many mining regions to increasingly emphasise the need for a more even sharing of the benefits of mining ventures. To this end, the strategy needs to first identify suitable monetary and non-monetary benefits for mining communities and, second, create the conditions to make the most of them.

In recent years, numbers for exploration permits (approximately 1 300 in 2008 and 600 in 2019) and exploitation permits have decreased in Sweden, while the number of appeals has increased (5 appeals between 2000 and 2008 and 12 appeals between 2009 and 2017). This suggests that the permitting process for mining development has become lengthier and more unpredictable. While slight improvements were made in the process – for instance by increasing staff and strengthening requirements for public consultations – there is room for improvement: changes to the system are needed to increase attractiveness for investors, especially small firms, resolve planning bottlenecks for municipalities and avoid tensions between interest groups.

Key challenges in the process include its complexity, limited transparency and separated decision-making on land use and other environmental factors that give only limited consideration to social, economic and cultural aspects as well as cumulative aspects of mining projects. In the current process, there is significant uncertainty on the scope and expectations for permit applications resulting in delays through additional

requirements and unpredictable authority intervention. This disadvantages small mining investors, which have limited resources in comparison to large established companies. Moreover, the segmented decision-making process in combination with weak definitions on which and how socio-economic, cultural and cumulative impacts are considered in decision-making reduces the possibilities for comprehensive decision-making assuring positive contributions to sustainable regional development.

Upper Norrland needs to strengthen its business ecosystem to mobilise its local assets and support a sustainable and resilient future for people and local business

Outmigration of young population and ageing have led to a shrinking workforce in the region

Upper Norrland faces a rapid population decline, mainly driven by outmigration of young population. Between 2000 and 2019, population growth in Upper Norrland (1.7%) was far below the rates of Sweden (15.2%) and the TL2 benchmark of mining regions (17.5%). The net amount of people leaving Upper Norrland (7.5% of its population in 2001-18) is the highest across all Swedish regions (2.4%) and above the level in TL2 benchmark of mining regions (2.6%). The majority of people leaving are young and female.

Alongside with outmigration, the elderly dependency ratio in Upper Norrland (36.6% in 2019) has increased almost twice as fast (9.2 percentage points) than in Sweden (5.2 percentage points) over 2001-19. International migration has helped mitigate the population decline but the region still needs to accelerate the intake of foreign people and retain them. At the TL3 level, Norrbotten is experiencing a higher outmigration and population ageing than Västerbotten. Mining municipalities in both regions are most affected by population decline (-3.8% on average between 2000-19) when compared to regional urban centres (17.5%).

Upper Norrland needs to further involve municipalities and SMEs in the innovation process of firms and universities, boost entrepreneurship culture and prepare its workforce for technological changes

Upper Norrland's municipalities and small businesses have a low interaction within the innovation process of firms and universities. Mining and manufacturing companies are the main drivers of the technological innovation process in Upper Norrland, with a weak involvement of municipal development strategies or local businesses. The traditionally nature-based economy and small market size have led to local economies being dominated by a small number of large mining firms, leaving many SMEs locked into supplier relationships. This phenomenon, coupled with a low unemployment rate, hampers incentives to create new companies in sectors outside mining. In this regard, both regions have scope to improve the implementation of their innovation strategy across all municipal governments and collaborate with large firms and universities to support entrepreneurship, particularly from women, and innovation capacity of small and micro firms.

To support the transition towards new economic activities linked to green technologies and to meet industry demands, Upper Norrland needs to ensure the supply of labour with the right skills. The region currently faces challenges to fulfil the labour demand of current and future industry needs (e.g. the future cluster of batteries). Furthermore, automation in mining and extractive industries poses a high risk of job displacement and change of labour demand while also offering opportunities to increase productivity, raise income and integrate new population segments in mining activities (young and women). To seize these benefits, the region needs to manage the transition processes targeting policies to upskill its labour force, especially to the most vulnerable workers.

Upper Norrland can improve internal and external co-operation to consolidate its vision of development and support global environmental agendas

Västerbotten and Norrbotten currently lack a common brand and vision to promote the region as a provider of environmentally sustainable practices and technologies. Both regions have differences in their economic structures, which provides scope for complementarities in strategic policies. The diversified economy of Västerbotten, with a higher share of services, can better support the industrial developments undertaken in Norrbotten's mines. A common vision will help to strengthen the co-ordination with the national government and attract international investment. To this end, both regions require a clear brand to become internationally visible as an attractive region on mining and environmental technology.

Upper Norrland's transition towards a high technological and know-how hub for environmentally sustainable mining and minerals value chains is very much in line with the efforts undertaken by various EU networks and international environmental agendas (EU and Arctic strategy). To make the most of these common goals, Upper Norrland needs to enhance its involvement in international mining networks and adopt an active participation in global environmental agendas (Arctic Strategy) by promoting the benefits of the carbon-free mining value chain.

A more developed and inclusive mechanism of dialogue and consultation with all local stakeholders is necessary to improve acceptance and promote sustainable mining in Upper Norrland

Local support for mining and extractive activities is crucial for the success of mining ventures and the social climate. In Sweden, opposition to mining has increased in recent years due to concerns around socio-environmental externalities and demands to recognise Indigenous peoples' rights. The institutional framework regulating permitting processes is not seen as fair or trustworthy by all parties. This is largely because the system provides few entry points to the process and offers limited direction or legal requirements for authorities and proponents on the structure and quality of consultations with local and regional stakeholders on mining development, including Indigenous Sami communities. This results in different standards applied across places and decreases the ability to identify critical issues early and better adopt a project proposal to the local environment and social context.

Relationships with Sami people are of particular importance in this context as 99% of the value of the mineral extraction was produced in Sápmi (region traditionally inhabited by the Sámi people) in 2016 and, to date, 12 mining concession permit applications for large-scale mines are within Sápmi. The absence of Sami rights to the ownership of land, as well as missing legislation on the "duty to consult" in the mining context, coupled with equalisation of reindeer herding along with minerals extraction as issues of public interest, generates uncertainty and conflict for all parties in northern Sweden.

In Västerbotten and Norrbotten, there is a need to better link regional development objectives with land use

Latest reforms have enabled Västerbotten and Norrbotten to take the lead in regional development including regional growth policy. Yet, these priorities and visions are not always reflected or considered in how land is planned as responsibilities for competencies related to economic development and land use are separated. Consequently, regional development programmes miss a physical planning perspective and municipal planning misses a regional development perspective. This is a challenge, as the expansion or introduction of extractive industries generates new land use and infrastructure requirements that have implications at the regional and municipal scales. Furthermore, land use decisions are often largely based on compliance with national guidelines (such as areas of national interests) and are limited in their flexibility to respond to rapidly arising needs. In order to deliver on regional development objectives in both TL3 regions, land use planning needs to be better linked to regional development. Developing a regional special plan can help to improve decision-making with regard to extractions for commodity production as well as

conservation of cultural and natural capital and offer a holistic description of how land is currently used and what is planned for the future.

Recommendations

Becoming a global leader in environmentally sustainable mining

I. Strengthen and update Sweden’s policy framework to become a lead country in sustainable mining. For this, the national government should:

1. **Define a long-term vision to clarify the role of mining for regional development** and support environmentally sustainable mining processes and technologies within the National Strategy for Sustainable Regional Growth, the Swedish Innovation Strategy and Sweden’s Mineral Strategy.
2. **Update the National Mineral Strategy to incorporate the local strategies around mining.** It involves clarifying the role of regions and municipalities in the implementation of the strategy, mobilising the potential of small businesses in mining value chains and helping prepare regions to face global megatrends. The Canada Minerals and Metals Plan is a good example of a national plan that involves both national and regional governments in strategic actions.
3. **Identify mechanisms to help mining regions capture greater value from ongoing and planned mining ventures.** This involves evaluating possible monetary and non-monetary benefit-sharing mechanisms for mining communities and the framework to make the most out of them.
4. **Strengthen the brand name of Sweden’s mining ecosystem to consolidate it internationally as a “sustainable mining” trademark.** This involves creating a single platform to consolidate and diffuse information on the national and local mining ecosystems as well as provide advisory services and networking activities.

II. Enhance the innovation ecosystem in Upper Norrland to become a global leader in environmentally sustainable mining. For this, the regional councils of Västerbotten and Norrbotten should:

5. **Strengthen the integration of municipal governments in the innovation process of universities and mining firms by:**
 - Formalising the co-operation between municipal governments and mining companies around innovation projects. This can be done through formal meetings open to local businesses, research institutions and non-mining and mining municipalities.
 - Promoting a formal collaboration among universities and regional and municipal development strategies to improve the innovation capacity of municipal governments. The regional councils can learn from the partnership between Karlstad University and Region Värmland.
6. **Enhance entrepreneurship culture and innovation capacity of mining suppliers and SMEs by:**
 - Strengthening the mechanisms to involve suppliers and SMEs in the innovation process of mining firms, especially concerning the transition to environmentally friendly practices. This includes collaborating with the large mining firms in the value chain (from producers to manufacturing) to lift standards and innovation of mining suppliers and associated SMEs. The example of the BHP accelerator programme for suppliers in Chile can be a guiding practice.
 - Boosting entrepreneurship culture and micro companies’ participation in innovation systems. This involves including an entrepreneurial angle to the education and training programmes for the young and working-age population as well as providing insurance support to entrepreneurs, with targeted programmes for women. Furthermore, the ongoing collaboration with universities needs to be expanded to engage smaller firms through training (i.e. personal counselling) and access to universities’ research equipment and staff for business needs.

7. Reinforce the implementation of smart specialisation strategies by:

- Developing an institutionalised platform for dialogue to monitor the implementation of the strategy and ensure continuous engagement of all actors. This platform should follow a cluster approach to channel funding for and implement strategies that connect mining innovation with other economic activities. This can follow the Georange model by expanding it to other sectors and get inspiration from the Lapland approach.
- Leveraging on European funds to align municipalities, universities and local businesses with the innovation strategy. This should involve a co-ordinated approach in applying for these funds, to realise policy complementarities among different levels of government in Upper Norrland.

III. Foment internal and external co-operation to consolidate Upper Norrland's vision of development and support global environmental agendas. For this, both regional councils should:

- 8. Define a common vision and brand for mining development in Västerbotten and Norrbotten.** This should capitalise on the existing Georange platform to develop a clear regional branding and strengthen international visibility by promoting the mining industry as a green and high technology industry.
- 9. Co-ordinate Västerbotten and Norrbotten regional development strategies to develop and internationalise technologies and practices for a carbon-free mining value chain.** This can be materialised through shared flagship projects that unlock synergies among ongoing local initiatives and actors, and attract funding from EU funds and external partners. Georange and the planned battery hub in Skellefteå can trigger such co-ordination.
- 10. Take a lead role in EU mining networks and Arctic co-operation to promote the benefits of the carbon-free mining value chain for global environmental agendas.** This involves enhancing its participation in international networks and increasing knowledge exchange with other Arctic regions, EU official and environmental actors to position sustainable mining processes as a relevant mechanism to support the EU and Arctic agenda for environmental transition and the EU agenda for self-sufficiency in raw materials.

Improving framework conditions for mining and sustainable regional development

IV. Strengthen the local business environment to make the most of mining and diversify the economy. For this, both regional councils and municipal governments should:

- 11. Develop an institutional body to promote and oversee co-operation among Upper Norrland's municipalities.** This can be done through an institutional body within the regional council or the creation of an inter-municipal development agency and should centralise economic information, co-ordinate municipal strategies and advise local businesses. Business Joensuu, in North Karelia, Finland, represents a guiding example for this type of structure.
- 12. Accelerate the attraction and integration of skilled migrants through better collaboration among municipalities and other regional actors.** This should involve enhancing job-matching services and exchange of information on migrants' skills among municipal governments as well as promoting further partnerships between migrant organisations, unions and businesses. Joint programmes with universities, industrial PhDs for example, can retain young people – especially women – and increase the attraction of new residents.
- 13. Improve training and education programmes to prepare the workforce for technological changes and further include women in value-added activities.** This should be done through joint work with mining companies and universities to align vocational education and training (VET) programmes with future industry needs, provide targeted grants for training to workers in jobs at

risk of automation (individual training accounts) and leverage technological changes to involve women in mining value-added activities.

V. Improve Sweden's regulatory framework to better reflect regional development opportunities and increase predictability. For this, the national government should:

- 14. Adopt instruments to improve predictability, by introducing set timelines for decision-making at the onset of an application process.** Outlining intermediate steps and windows for feedback and dialogue can provide project proponents with more clarity on when determinations are made and ensure that public consultations are planned with sufficient lead-time.
- 15. Strengthen the incorporation of socio-economic, cultural and cumulative impacts in decision-making for mining concessions and environmental permits.** This requires developing detailed explanations in the legislative language of the Environmental Code and other provisions that describe these impacts as well as drafting detailed guidance for project proponents on how impacts should be assessed. Considerations of cumulative aspects should include their contribution to regional development objectives and make use of context-specific sustainability-based criteria that account for special and temporal impacts and interrelationships.

VI. Increase legitimacy and transparency of mining and permitting processes through more developed and inclusive mechanisms of dialogue and consultation with all local actors, including Sami people. For this, the national government should:

- 16. Develop clear and consistent guidelines for the mining industry.** It should define how the consultation process should proceed and who should be involved in the process by including parameters around what type of information is provided to communities at each step of the process. This should also clarify to what extent project proponents and responsible authorities ought to take voiced perspectives and positions into account. Specific guidelines for consulting with Sami villages should be developed together with the Sami Parliament and other Sami stakeholders. These should also define the status of Sami traditional knowledge in the consultation.
- 17. Ensure early-stage engagement and consultation rules within the framework of the Minerals Act and Environmental Code.** This should include how and when notifications should proceed and the nature of the engagement (format, etc.) as well as required documentation.
- 18. Strengthen the capacity of rights holders and interested parties for engagement, including Sami villages.** This should entail that proponents need to provide financial resources to affected parties to compensate for the cost incurred in corporate consultation without any obligation influencing the outcome. Further, greater overall institutional and analytical capacity should be provided to special interest holders to manage demands for consultation. For affected Sami people, the Sami Parliament could play a stronger co-ordinating role in distributing information to Sami villages with regards to making contributions in consultations, conducting consultations and making agreements with mining companies.

VII. Better linking regional development with land use and resources planning. For this, regional councils should:

- 19. Create an effective co-ordination mechanism that allows for strategic dialogue about land use and economic development between municipalities and regional councils.** Planning based on potentials and opportunities can be incentivised by developing strategic spatial plans at a regional scale. Regional spatial plans should account for interrelationships at the functional scale and can help guide regional and municipal planning. It should also be used to guide decisions made on regional development policies and cumulative impacts through informing the platform for resource development.

- 20. Develop a platform for resource development to facilitate regional and sustainability-based planning for mines and natural resource projects together with other actors.** The platform would oversee all mining and potentially other infrastructure and energy applications in the region, compile information on land use through a geospatial database and act as a contact point for all stakeholders, including authorities, proponents for mining projects and landowners, interest holders and the general public. It could help to reduce frictions of multiple reviews and entities, ensure the neutrality of consultation processes and inform decision-making on developments with regards to land use and cumulative effects.

2 Strengths and challenges in the regional development of Västerbotten and Norrbotten

This chapter provides a diagnostic of the region of Upper Norrland in Sweden, its two TL3 regions, Västerbotten and Norrbotten, and its mining municipalities. By comparing with national trends and a benchmark of TL2 and TL3 OECD mining regions, the analysis identifies major trends, strengths and bottlenecks to development and diversification of the nature-based economy. The chapter begins with an overview of the main megatrends affecting regions specialised in mining and extractive activities. The second section sets up the scene and provides a profile of Upper Norrland, Västerbotten and Norrbotten. The third section analyses the demographic labour market trends across the regions. The fourth section describes the main economic trends and the relevance of mining in the regional economies. Finally, the chapter describes the enabling factors for development in Upper Norrland.

Assessment and findings

Assessment

Upper Norrland is Sweden's northernmost region and has the largest land area and lowest population density in the country (3.4 inhabitants per square kilometre). It is a key mining region at the national and European levels, concentrating 9 of the 12 active mines in Sweden and providing 90% of the iron ore production in Europe. Upper Norrland includes two Territorial Level 3 (TL3) regions (Västerbotten and Norrbotten). Amongst the two, Västerbotten is more densely populated (4.8) and hosts the largest city in the region (Umeå with 24% of Upper Norrland's population). Norrbotten, in turn, has the largest land area in Upper Norrland (64%) and is the traditional mining region in the north, concentrating most of the active mines and relatively larger production volumes than in the rest of Sweden. Large Swedish companies dominate Upper Norrland's mining ecosystem. In Norrbotten, the state-owned company LKAB is the main player, working closely with networks of local suppliers. In contrast, Västerbotten's ecosystem is relatively more diverse, complemented by the presence of a number of junior mining companies and small- and medium-sized enterprises (SMEs). In both regions, the Swedish private company Boliden is highly active.

This chapter identifies some important findings for Upper Norrland and its TL3 regions by comparing them with the OECD mining regions:

- Upper Norrland has the third-highest level of gross domestic product (GDP) per capita (USD 44 290) across the 8 TL2 regions in Sweden and surpasses the average of TL2 benchmark of mining regions (USD 42 087). Over the last 20 years, Upper Norrland has been closing the GDP-per-capita gap with the national average by 22% (from USD 5 097 in 2001 to USD 3 975 in 2017), mainly driven by a faster recovery after the financial crisis. During the post-crisis period (2010-17), the region registered the largest GDP per capita growth (3.0% annual average) across Swedish regions (average growth of 1.7%) and exceeded the average growth of the OECD TL2 mining regions (0.4%). This performance was mainly driven by Norrbotten, that experienced a peak growth right after the crisis (29% annual growth in 2009) following the rebound of international commodity prices. The region is dominated by industrial activities linked to natural resources (including energy and mining) and benefits from a higher share of tradeable activities than the national level. Yet, services represent just a small share of the tradeable sector, which can limit the gains from international trade as services tend to be linked with higher-value-added activities in global value chains (GVCs).
- The region also benefits from high labour productivity due to its vibrant industrial sector. Labour productivity of the 2 TL3 regions, Västerbotten (USD 78 729 in 2015) and Norrbotten (USD 87 743) is higher than the comparable OECD TL3 mining regions (USD 78 557). Historically, Norrbotten's labour productivity has been higher than in Västerbotten and after the crisis, the productivity gap among the regions doubled (from an average of USD 7 478 during 2000-07 to an average of USD 14 384 during 2009-15).
- Upper Norrland also has a relatively lower unemployment rate (5.1%) than Sweden (6.9%) and the TL2 OECD mining regions (7.3%). Västerbotten, in turn, exhibits a lower unemployment rate (5.5% in 2019) than Norrbotten (6.0%) but the rate of both regions remains below the average of TL3 OECD mining regions (7.4%). In particular, the rural and mining municipalities have a lower unemployment rate than urban centres of the region, mainly associated with the high-income growth and the shrinking of the workforce.

- Nevertheless, the high reliance on the mining sector has exposed Upper Norrland' economy to external shocks. The GDP of Upper Norrland has experienced higher volatility (USD 3 640 standard deviation during 2001-16) than the one of Sweden (USD 2 800) and the OECD TL2 mining regions (USD 2 185). At the TL3 level, Norrbotten has proven to be a more volatile economy (USD 4 963 standard deviation) than Västerbotten (USD 2 600), experiencing a more severe drop during the crisis and then a faster recovery. Such vulnerability to external shocks is associated with greater specialisation in mining activities than Västerbotten. Furthermore, the high reliance on mining activities and the low unemployment rate has hampered the creation of new businesses in the region. While the absolute growth of companies in Upper Norrland is positive, the rate of creation of new businesses is lower than in the rest of the country, with the size of companies in term of employees getting smaller. Reducing the reliance on mining and the consequent volatility of its economy should be of interest to the entire Upper Norrland region in order to ensure sustainable and sustained growth.
- Despite the rapid economic growth, Upper Norrland has faced a high shrinking of its workforce (from a share of 64.2% of the total population in 2001 to 61% in 2019). Between 2000 and 2019, population growth in Upper Norrland (1.7%) was far below the growth rates of Sweden (15.2%) and the TL2 benchmark of mining regions (17.5%). This phenomenon is driven by a high rate of outmigration, especially from young women. The net amount of people leaving Upper Norrland (7.5% of its population between 2001 and 2018) is the highest across all Swedish regions (2.4%) and above the level experienced by the TL2 benchmark of mining regions (2.6%). The population decline in Norrbotten (-2.9%) explains most of the negative demographic trend in the region, which contrasts with the positive trend in Västerbotten (3.6%) and the benchmark of TL3 mining regions (19.4%). International migration has helped mitigate the population decline but the region still needs to accelerate the intake of foreign people.
- Alongside outmigration, the elderly dependency ratio of Upper Norrland (36.6% in 2019) has increased almost twice as fast as Sweden as a whole (9.2 percentage points vs 5.2 percentage points between 2001-19), reaching levels above the national average (31.9%) and the OECD TL2 mining regions (20.5%). At the TL3 level, Norrbotten is experiencing higher outmigration and population ageing than in Västerbotten and the benchmark of TL3 mining regions. Within the region, mining municipalities are the most affected by population decline (-3.8% in average between 2000-19), which contrasts with the population growth of the regional urban centres (17.5%), driven mainly by rural-urban outmigration of the young population.
- Upper Norrland has a number of assets to support new growth opportunities. The region has a relatively high-educated workforce, an innovative environment and high standards of public services. The share of the labour force with tertiary educational attainment in Upper Norrland has risen from 30.1% in 2010 to 35.7% in 2017, reaching a higher level than the average of TL2 OECD mining regions (34.5%). The large coverage of quality broadband has also allowed the sparse population to access health and education services. Overall, the share of households connected to broadband in Upper Norrland (99% in 2019) is above the average of European (98% on average in 2019) and OECD TL2 mining regions (70% on average in 2017). The region also stands out across OECD TL2 regions and OECD TL2 mining regions thanks to its high environmental quality, security rate and level of the population engaged in politics.
- The 2020 coronavirus pandemic is causing a global slowdown with containment measures, halting economic activity and mobility. As was the case during the 2009 global financial crisis, rural economies are particularly vulnerable to the crisis due to their less diversified economic base, a greater dependency to fluctuations in external demand and a shrinking workforce. The effects of the slowdown in Upper Norrland were amplified given its specialisation in the mining

industry – a sector hardly hit by the drop of global demand from the manufacturing and construction sectors. The challenges facing Upper Norrland in this new crisis are being to demonstrate its resilience in the face of the slowdown, retain the young population and high-skilled workers and attract the skilled migrants while adapting its labour force to new ways of working through technological changes. Specific measures are needed to ensure that the potential of the innovative mining sector in the Upper Norrland region is harnessed and that diversification efforts are deepened to sustain economic growth in the medium and long term.

Introduction

This chapter provides a diagnosis of Upper Norrland, Sweden, and its two Territorial Level 3 (TL3) regions Västerbotten and Norrbotten, by comparing with national trends and a benchmark of TL2 and TL3 OECD mining regions. This analysis identifies major trends, strengths and bottlenecks to development and diversification of their nature-based economy. The chapter begins with an overview of the main megatrends affecting regions specialised in mining and extractive activities. The second section sets the scene and provides a profile of Upper Norrland, Västerbotten and Norrbotten. The third section analyses the demographic labour market trends across the regions. The fourth section describes the main economic trends and relevance of mining in the regional economies. Finally, the chapter describes the enabling factors for development and the quality of life in Upper Norrland.

To better understand the current context in the mining regions, the analysis presented in this section adopts the OECD regional framework to selected OECD regions specialised in mining. The aim is to identify trends specific to mining regions and investigate how outcomes in different dimensions have evolved over time. The regional classification (TL2 and TL3 level) follows the new OECD territorial classification (Box 2.1).

The analysis first identifies 40 OECD TL2 regions specialised in mining. To identify these comparable regions specialised in mining, two methods are applied. As a first step, OECD TL2 regions are selected according to their sectoral employment share in the industry and location quotient (the ratio of the regional share in industry – excluding manufacturing – to the national share). Only regions with a location quotient higher than 1.9 are selected. A value above 1 in the location quotient implies that the region is more specialised in that sector than the rest of the economy. As a second step, desk research was undertaken to identify the regions with a specialisation in industry (mining, energy and water) that currently have mining activities. Annex 2.A provides a full list of elected OECD TL2 mining regions.

However, the analysis at the TL2 level needs a more local approach. Therefore, a second benchmark was built at the TL3 level. It aims to analyse the performance of the TL3 regions of Upper Norrland, Västerbotten and Norrbotten, against national trends and other OECD TL3 regions specialised in mining and extractive activities. The analysis identifies 11 OECD TL3 regions with similar characteristics to Västerbotten and Norrbotten according to two aspects: the degree of rurality and the share of industrial activities linked to natural resources. The selection of the TL3 benchmark of mining regions follows three criteria:

- Each TL3 rural remote region in the European Union (EU) was ranked according to its sectoral share in industry and location quotient (the ratio of the regional share in industry to the national share).
- Regions with comparable population size to Västerbotten and Norrbotten were selected.
- Desktop research was carried out to identify the regions with a similar level of specialisation and population size with current mining activities and/or legacy of mining.

Based on the procedure, the following 14 regions were selected for comparison to Västerbotten and Norrbotten:

- 1. Karlovy Vary (Czech Republic)
- 2. Oder-Spree, 3. Celle, 4. Görlitz, 5. Anhalt-Bitterfeld and 6. Saaleskreis (Germany)
- 7. Carbonia-Iglesias (Italy)
- 8. Noord-Drenthe, 9. Overig Zeeland and 10. Zuidoost-Drenthe (Netherlands)
- 11. Rogaland (Norway)
- 12. León (Spain)
- 13. Kalymnos, Karpathos, Kos, Rhodes and 14. Heraklion (Greece).

Box 2.1. OECD TL3 revised typology

The OECD regional database collects and publishes regional data at two different geographical levels, namely large regions (Territorial Level 2, TL2) and small regions (Territorial Level 3, TL3). Both levels encompass entire national territories. With some exceptions, TL2 regions represent the first administrative tier of sub-national government (i.e. states in the United States, *estados* in Mexico, or *régions* in France). TL3 regions are smaller territorial units that make up each TL2 region.

The OECD has adopted a new typology to classify administrative TL3 – Territorial Level 3 - regions. This classification allows measuring socio-economic differences between regions, across and within countries. It is based on the presence and access to functional urban areas (FUAs), a concept defining cities and the urban hinterland, in other words, urban economic agglomerations.

By controlling for these regional characteristics, the typology classifies TL3 regions into two groups, metropolitan and non-metropolitan regions. Within these two groups, five different types of TL3 regions are identified. Metropolitan regions (MRs) adopt 50% of the population of the TL3 (small) region living in an FUA of at least 250 000 people as a threshold; non-metropolitan regions (NMRs) use 60-minutes' driving time as a threshold, a measure of access to a FUA.

The methodology follows the criteria below:

- **Metropolitan TL3 region**, if more than 50% of its population live in a FUA of at least 250 000 inhabitants. MRs are further classified into:
 - **Large metropolitan TL3 region**, if more than 50% of its population live in a FUA of at least 1.5 million inhabitants.
 - **Metropolitan TL3 region**, if the TL3 region is not a large metropolitan region and 50% of its population live in an FUA of at least 250 000 inhabitants.
- **Non-metropolitan TL3 region**, if less than 50% of its population live in a FUA. NMRs are further classified according to their level of access to FUAs of different sizes into:
 - **With access to (near) a metro TL3 region (NMR-M)**, if more than 50% of its population lives within a 60-minute drive from a metropolitan area (a FUA with more than 250 000 people); or if the TL3 region contains more than 80% of the area of a FUA of at least 250 000 inhabitants.
 - **With access to (near) a small/medium city TL3 region (NMR-S)**, if the TL3 region does not have access to a metropolitan area. Fifty percent of its population has access to a small or medium city (a FUA of more than 50 000 and less than 250 000 inhabitants) within a 60-minute drive; or if the TL3 region contains more than 80% of the area of a small or medium city.
 - **Remote TL3 region**, if the TL3 region is not classified as NMR-M or NMR-S, i.e. if 50% of its population does not have access to any FUA within a 60-minute drive.

The described procedure leads to more statistical consistency and interpretable categories that emphasise urban-rural linkages and the role of market access.

Megatrends affecting regions specialised in mining and extractive activities

A number of megatrends have the potential to alter the future development of mining regions. Global megatrends including demographic change, climate change and the transition to a low-carbon economy as well as digitalisation and automation modify the way people live and consume and, consequently, how industries produce. As mining industries need to adapt to change, so do the regions where extraction is taking place. In light of these megatrends, the geographically concentrated nature of mining, as well as the usually high economic specialisation within mining regions, poses particular challenges and opportunities for prosperity and well-being in mining regions. For instance, regions specialised in hydrocarbons will face the challenge of transition and diversification towards a climate-neutral economy, while others might experience growth from the increased demand for materials needed to produce sustainable energy. Furthermore, regional mechanisms to retain attract and upskills workers will need to be adjusted in light of digitalisation and automation in the mining industry. This section outlines the key opportunities and challenges mining regions face concerning three global megatrends: demographic, climate change as well as technological shift and automation.

Mining regions will likely face a shrinking labour force

Demographic trends are increasingly changing the labour market structure in rural regions. In developed countries, mining is largely concentrated in rural and remote regions, far from large cities (OECD, 2017^[1]; Moritz et al., 2017^[2]). These regions face a relatively high degree of outmigration and ageing population compared to urban regions (OECD, forthcoming^[3]). In most OECD countries, populations have increasingly concentrated in large cities, driven by younger people seeking education and job opportunities (OECD, 2019^[4]). The trend in mining regions is exacerbated by the outmigration of women, who tend to leave because of the lack of equal employment opportunities in the mining industry (Abrahamsson, 2006^[5]). These structural changes have led to a shrinking labour force in rural and mining municipalities, which pose challenges in terms of meeting the industrial demand for labour, delivering quality services and sustaining local fiscal revenues. Consequently, attracting people and retaining them in the long-term – especially women – is a key challenge for many mining regions. Enhancing regional attractiveness requires an integrated approach that goes beyond economic incentives such as high salaries and job security and includes connectivity, safety, cultural vitality, quality of goods and services as well as social networks.

On the upside, increased agglomeration around cities will boost the demand for minerals and materials from construction. Especially cities in Africa and China are expanding rapidly and demanding an increasing amount of materials such as coal, copper and steel, both for construction and consumption (OECD, 2019^[4]). This will maintain the demand for minerals and opportunities for income flow into mining regions. Increased urbanisation will also require more sustainable ways of living to reduce the large carbon footprint of cities. Many of the needed technologies (i.e. electric batteries, solar panels) as well as low-carbon infrastructure (i.e. intelligent buildings, zero-carbon transport systems) require rare metals and minerals (i.e. cobalt, lithium). These rare minerals can be extracted using unexploited deposits as well as the use of new technology that enable sourcing materials from waste or recycling them (Chapter 3).

Mining regions need to prepare for a transition to a low-carbon economy

Increased impacts of climate change have led governments to accelerate the transition towards a low or even zero-carbon economy (UNFCCC, 2015^[6]). The transition requires increasing energy supply from renewable sources and the development of materials and technologies that reduce carbon emissions. Such transition represents important opportunities and challenges for mining regions. Phasing out of hydrocarbons (coal, oil and gas) as a power source is key to advance in energy transition objectives.

Carbon intensive mining is often important for employers in regions with low economic diversity. The phasing out can thus threaten local livelihoods and prosperity in these regions. On the upside, the development of renewable energy and green technologies requires an increasing amount of traditional (iron, copper) and rare (lithium, cobalt) minerals (Olsson, Rasmus and Larsen, 2019^[7]). This is an opportunity to grow for mining regions and will provide opportunities to promote innovation and create new economic opportunities from sustainable resource use.

Mining operations also have environmental impacts and contribute to greenhouse emissions. The extraction and primary processing of metals accounts for 26% of global carbon emissions (UNEP, 2019^[8]). In light of growing demand for minerals and metals – the world consumption of raw materials is set to double by 2060 –, the extractive industry is required to contribute to the mitigation of climate change and become more sustainable. Many companies address this by investing in electrified vehicles, reducing CO₂ emissions throughout their value chains and increasing recycling. The circular economy, for instance, will present new business opportunities and productivity improvements in mining by linking production processes. This way, the value of products, materials and resources is maintained for as long as possible and waste is significantly reduced or even eliminated (OECD, 2019^[4]). Further, there is an increasing demand from certain parts of the civil society to conserve the current stocks of natural capital and preserve the landscape (Olsson, Rasmus and Larsen, 2019^[7]). This requires an improved process for social engagement and license to operate for existing mines and new mining projects.

Technological change and digitalisation will open new opportunities for mining regions

Technological change and digitalisation can further reduce the cost of moving people and goods and delivering services. They can help rural areas to address demographic shifts by promoting innovative ways to provide public services (e-Health, e-Education) and work (teleworking, meetings through augmented reality) (OECD, forthcoming^[3]). Automation also brings positive and negative disruptive effects on local economies. On the upside, automation offers a path to revive productivity growth by creating new jobs and allocating low-skills workers to new sectors (Autor and Dorn, 2013^[9]). On the downside, automation can lead to large-scale job losses and high unemployment (Cosbey et al., 2016^[10]). Overall, the effect of new technologies on the local labour markets will very much depend on the readiness and adaptability of regional policies (see Chapter 3).

Technological progress can make mines more productive and environmentally friendly while offering new work opportunities to the local workers. The transition to a future digital mine will change core-mining processes and will encompass the automation of physical operations and digitalising assets. Autonomous vehicles, drones, GPS (global positional system) and wearable technologies, can operate through a connected network that uses the Internet of Things (IoT), allowing part of the mining operators to work primarily from above ground or distant centralised control centres (OECD, forthcoming^[3]). Yet, a share of tasks will still need human service around the core production, including asset maintenance or logistics services. Hence, automation will lead to the creation of new types of jobs, for example in the development and monitoring of remotely controlled autonomous equipment and in data processing. These new tasks have the scope to offer higher income and quality of life to mining workers as well as involve a larger share of women in mining activities. At the same time, they will demand different skills and up-to-date training to manage technological changes. However, automation is likely to threaten the number of operational jobs in mining. Occupations with a high share of repetitive tasks in mining face the highest risks of job automation. These areas include drilling, blasting and train and truck driving, and typically constitute over 70% of employment in mines (Cosbey et al., 2016^[10]).

Upper Norrland is likely to be affected by these megatrends. As this chapter and the rest of the review will show, some of the structural challenges underlying demographic changes, pressures to transition to zero-carbon economy and effects from technological progress are already occurring within the mining

ecosystems of Västerbotten and Norrbotten. Ultimately, Chapters 3 and 4 will stress that the type of impact from the megatrends on mining municipalities will very much depend on the policies in place to address the changes and prepare local businesses and communities for future changes.

Table 2.1 Opportunities and challenges of megatrends for the mining industry and regions

	Opportunities	Challenges
Changes in demographic trends (population ageing and migration)	<ul style="list-style-type: none"> - Successful integration of migrants may enhance labour supply. - Lifelong learning can enable the old workforce to keep adding value. 	<ul style="list-style-type: none"> - Ageing population/local demographic decline leads to a shortage of labour. - Unsuccessful migrants' integration may lead to social problems. - Many migrants tend to reside only temporarily in northern Sweden and eventually move south to larger cities.
Climate change and environmental pressures	<ul style="list-style-type: none"> - High standard of environmental performance and requirements will soon be a competitive advantage for regions that have transitioned to fossil-free, low-electrified mining and the development of environmentally friendly technologies to reduce carbon emissions in mineral and metal processes. 	<ul style="list-style-type: none"> - Pressures on the mining industry to improve its performance and reduce its environmental footprint. - Harder policies and regulations to issue permits to operate in the future. - Higher public reticence to accept mining explorations and openings.
Technological change and innovation (e.g. digitalisation, automation, decentralised energy)	<ul style="list-style-type: none"> - Digitalisation/automation may compensate for shortages of labour in some sectors. - Can make mining regions more attractive to live in by providing quality public services, including remote healthcare solutions. - Creation of new jobs by involving regional actors in the development of new digital and automated solutions. - Offer greater labour opportunities for women and various segments of the population. 	<ul style="list-style-type: none"> - Displace certain workers in the mining sector, mainly the ones that perform more repetitive tasks. - If technological innovation is produced outside the region, it can affect the competitiveness of the region. - Can reduce the need for certain minerals by replacing them with laboratory products or by extracting them from the recycling process.

Upper Norrland, the mining region of Sweden

Geography and climate shape a low-density settlement structure

Upper Norrland is the northernmost region of Sweden and the largest region by land area. It borders Finland, Norway and Middle Norrland. It includes two TL3 regions, Västerbotten and Norrbotten. The TL3 region of Västerbotten is 1 of the 21 administrative regions that constitute Sweden. It shares the counties of Jämtlands, Norrbotten and Västernorrlands.

Västerbotten is home to 268 465 inhabitants, making it the biggest region of Upper Norrland. Its population is spread out in 15 municipalities, including the capital of the TL3 region Umeå (84 761 inhabitants), which is the largest city in Upper Norrland and ranks as the 13th largest city in Sweden. Norrbotten, on the other hand, is the northernmost TL3 region in Sweden. It is also the largest region of Upper Norrland in terms of land area (64% of Upper Norrland's area). It shares a regional border with Västerbotten and a frontier with Finland and Norway. There are 14 municipalities within Norrbotten and its main city is Luleå with 77 832 inhabitants. Consistent with the OECD regional typology, Västerbotten and Norrbotten are classified as remote TL3 region.

Upper Norrland has the smallest share of built-up land area in Sweden. Upper Norrland is Sweden's largest heathland and herb meadow region. In particular, Norrbotten is the TL3 region with the largest land area

dedicated to heathland and herb meadow (19% of total land area) and the smallest built-up area (including housing and industry, 0.7%) in the country (Figure 2.2). A similar effect occurs in Västerbotten. It is the third lowest TL3 region in terms of built-up area (1.3%), with forest covering most of its territory (73%). It represents a great environmental asset and an important economic sector in the region.

Figure 2.1. Västerbotten, Norrbotten and mining municipalities (selected)

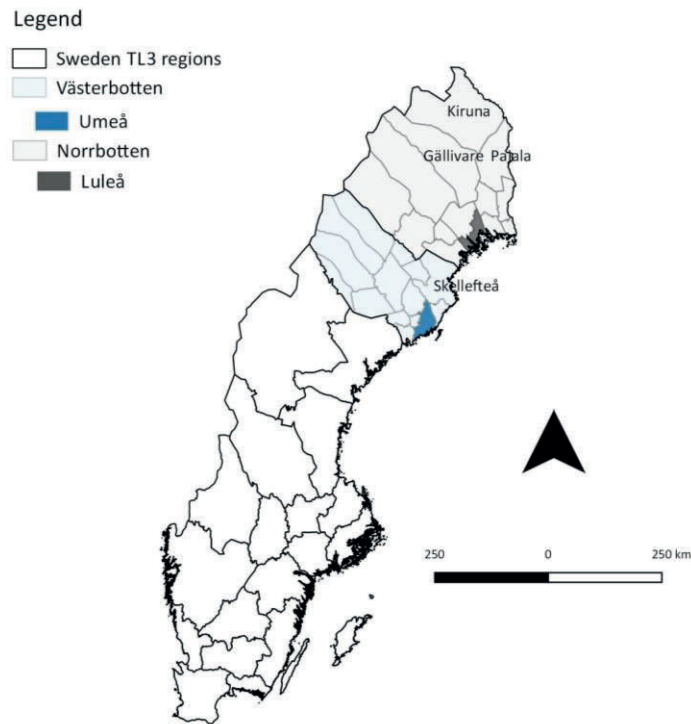
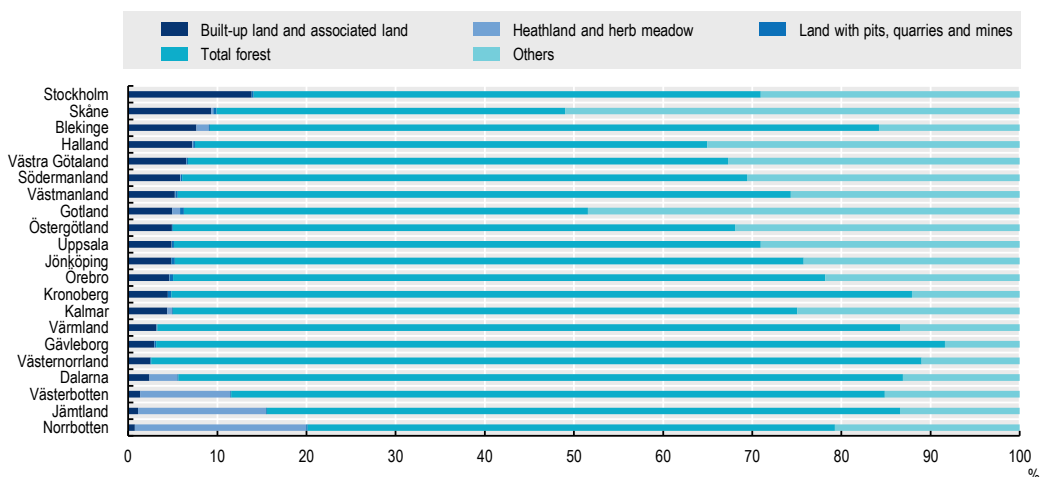


Figure 2.2. Land use in Sweden’s TL3 regions, 2018



Note: Total forest includes productive and non-productive forest. Others include arable and grazing land, land used for golf courses and ski runs, bare rock and other land, and open mine.

Source: Statistics Sweden (2019^[11]), *Statistical Database*, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_BE_BE010_BE0101A/?rxid=3a012fe9-414f-47c2-8b84-25feb829e48d (accessed on 5 June 2019).

Upper Norrland has five local labour markets (LLMs) that represent an economic enclave within the region (Jokinen et al., 2020_[12]). Identifying the LLMs is important to understand the labour dynamics and the centres of economic activity in a region (Box 2.2). LLMs contain at least two contiguous municipalities where there is a significant degree of commuting across municipal borders and a central municipality where most workers of the LLM commute daily to work. Västerbotten has three of Upper Norrland's LLMs, with Lycksele, Skellefteå and Umeå as central municipalities for each of them (Table 2.2). As the biggest city in the region, Umeå is the centre of the largest LLM in terms of population in Upper Norrland (127 119 inhabitants in 2018). In Norrbotten, there are two LLMs with Kiruna and Luleå as the main centres. Some municipalities form self-contained or independent LLMs, which are characterised by single municipalities that have a particularly strong – location-specific – advantage that offsets its high degree of geographic isolation or/and limits opportunities for commuting. Gällivare in Norrbotten is one example of a self-contained LLM with most of its inhabitants working in the same municipality and relatively low daily commuting from other areas.

Table 2.2. LLMs and municipalities in Upper Norrland

TL3 region	Local labour market	Municipality
Västerbotten	Lycksele	Lycksele
		Malå
	Umeå	Bjurholm
		Nordmaling
		Robertsfors
		Umeå
		Vindeln
		Vännäs
	Skellefteå	Skellefteå
		Norsjö
Norrbotten	Luleå	Boden
		Luleå
		Älvsbyn
		Kalix
		Piteå
	Kiruna	Kiruna
		Pajala

Source: Jokinen, J. et al. (2020_[12]), *State of the Nordic Region 2020*, <http://dx.doi.org/10.6027/no2020-001>.

Box 2.2. Local labour markets in Northern Sparsely Populated Areas

LLMs are relevant units of analysis for sparsely populated areas as Upper Norrland, given that they offer the best opportunity for additional economic growth and demographic stability. This does not mean that municipalities that are not integrated into an LLM should be ignored, nor that economic growth takes place in all current LLMs, but that the LLMs offer the best opportunity to understand how and where economic progress is currently taking place in the Northern Sparsely Populated Areas (NSPA). Special characteristics of LLMs are:

- LLMs correspond to where economic activity is concentrated because the size of an LLM is related to the size of the local economy.
- The size of the LLM is a rough proxy for demographic sustainability as larger LLMs are associated with in-migration, while self-contained LLMs are associated with demographic decline.
- LLMs correspond to a local economy since they capture both the aggregate local demand for labour that comes from a particular set of employment opportunities and the available local supply of labour that consists of workers who are prepared to travel for work.

LLMs for the NSPA regions were built by fulfilling at least the following criteria:

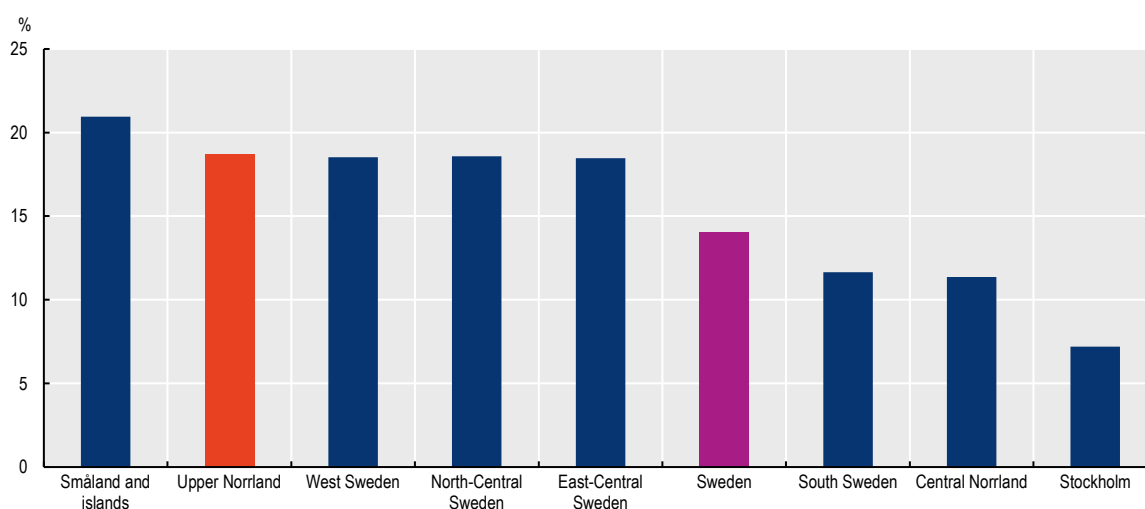
- Municipalities belonging to an LLM should have a single out-commuting flow to another municipality that is more than 7.5% of its employed population. The central municipality in the LLM is determined by having more internal employment than commuting employees and an out-commuting rate of less than 20% of the employed population.
- In the case where a municipality has less than the threshold level of out-commuting, it is described as a self-contained LLM.

Source: Jokinen, J. et al. (2020^[12]), *State of the Nordic Region 2020*, <http://dx.doi.org/10.6027/no2020-001>; Freshwater, D., A. Simms and J. Ward (2014^[13]), "LLMs as a new way of organizing policies for stronger regional development in Atlantic, Canada".

Northern Sweden is one of the most mineralised areas in Europe

Mining is a relevant sector for the national economy and Upper Norrland is the region with the largest mining production and number of mines in the country. The mining sector represents 4.2% of the national gross value added (GVA). Upper Norrland concentrates 9 of the 12 active mines in Sweden, focused mainly on metal extraction including, copper, iron ore and gold. Mining in Upper Norrland represents 19% of its regional GDP, ranking as the second TL2 Swedish region with the highest share of mining in the regional GDP. As a share of the national economy, Upper Norrland represents 4.8% of Sweden's GDP (2018).

Figure 2.3. GDP share of mining, quarrying and manufacturing over total GDP, 2017



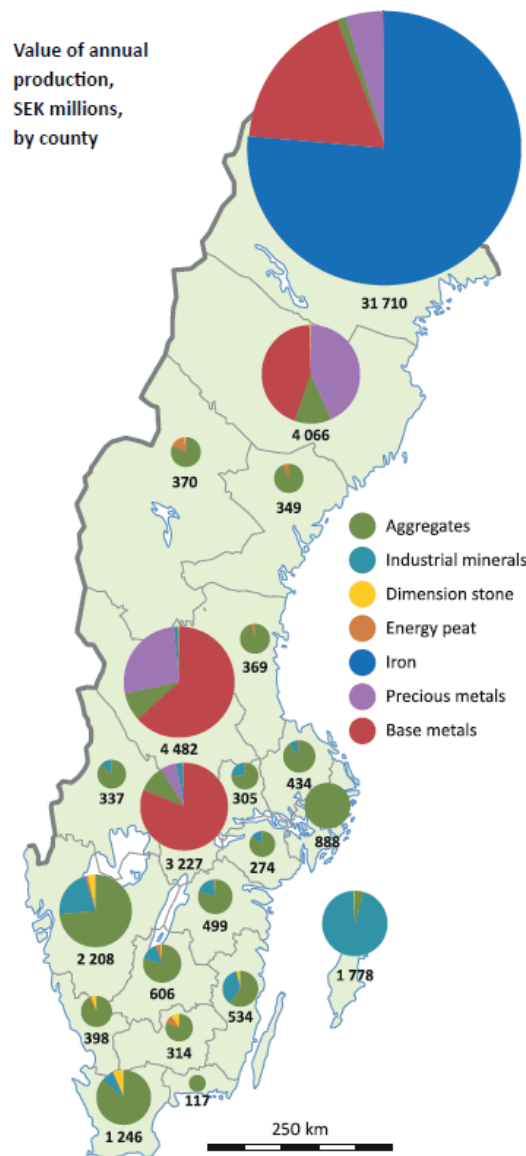
Note: GDP current prices, million SEK by region calculated as a percentage.

Source: Statistics Sweden (2019^[11]), *Statistical Database*, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_BE_BE0101_BE0101A/?rxid=3a012fe9-414f-47c2-8b84-25feb829e48d (accessed on 5 June 2019).

At the TL3 level, Norrbotten is the largest region in mining production (Figure 2.3). The TL3 region has five of the active mines in Sweden, focusing its mining extraction on copper and iron ore. Norrbotten has all the iron ore mines of Sweden and the largest underground iron ore mine in the world (in Kiruna municipality). The region has also Europe's largest copper mine, Sweden's largest gold mine (Aitik in Gällivare) and iron ore open-pit operations in Kiruna, Pajala and Svappavaara.

The case of Västerbotten has many similarities, as the backbone of the regional economy has been mining, forestry and energy. Its capital, Umeå, has emerged as a port to trade timber from the interior and goods from Lapland. Västerbotten has a large mining industry, which includes the extraction and processing facilities of gold, copper and zinc from its four active mines.

Figure 2.4. Value of annual production in SEK millions by TL3 region, 2018



Note: Aggregate is the name for gravel, sand and crushed bedrock. Aggregates are used in concrete and asphalt as a filler and as railway track ballast, among other things.

Source: Geological Survey of Sweden (2018^[14]), *Fact about Minerals & Metals 2018*, <https://www.sgu.se/globalassets/mineralnaring/facts-about-minerals-and-metals-2018.pdf>.

Within these regions, mining is mainly concentrated in rural municipalities. The municipalities with the most mining activity in Norrbotten are Gällivar, Kiruna and Pajala, between three- and four-hours' drive by car from Luleå respectively. Luleå is a key player for the mining value chain of Norrbotten by hosting one of LKAB's harbours and the processing facilities for iron and steelmaking of the manufacturing company SSAB, earlier called Svenskt Stål AB. In Västerbotten, the main mining municipalities are Lycksele, Malå and Skellefteå, which are relatively closer to the regional urban centre, at less than two hours ride to Umeå. This chapter includes analysis on the performance of Upper Norrland's mining municipalities in comparison with the main urban centres of the region, Luleå and Umeå. The chapter will take Kiruna as a proxy of the

dynamics in Gällivare due to the similar number of inhabitants in these municipalities. Jokkmokk in Norrbotten has been included in the analysis as this municipality has experienced an important interest in mining exploration in recent years (Chapter 4). Table 2.3 describes the main municipalities that will be analysed in this chapter.

Table 2.3. Cities and mining municipalities selected in Upper Norrland, 2018

Municipality	Population	Density (individuals/km ²)
Umeå	127 119	24
Luleå	77 832	16
Skellefteå	72 467	7.3
Kiruna	22 992	1.1
Lycksele	12 228	8.5
Pajala	6 039	0.75
Jokkmokk	5 001	0.26

Note: Number of inhabitants in 2018.

Source: Statistics Sweden (2019^[11]), *Statistical Database*, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_BE_BE0101_BE0101A/?rxid=3a012fe9-414f-47c2-8b84-25feb829e48d (accessed on 5 June 2019).

At the TL3 level, Norrbotten is particularly focused on mining and forestry. Mining is vital to the economic performance of the region and accounts for 90% of the iron ore production of Europe, owning all the iron ore mines of Sweden. Production in 2018 from Kiruna, Malmberget and Svappavaara amounted to 26.9 million tonnes, while Boliden Aitik 2019 produced 38.4 million tonnes. The case of Västerbotten has many similarities; the backbone of the regional economy has been mining, forestry and energy. The city emerged as a port to trade timber from the interior and goods from Lapland. The region has a large mining industry, which includes the extraction and processing of gold, copper and zinc.

Settlements patterns have low density and are shrinking

Inhabitants and population density

Upper Norrland has the lowest population density in Sweden. In 2018, the region of Upper Norrland was home to 519 760 people (Table 2.4), which represents 5.1% of the national population. Measured by population, Upper Norrland is the second smallest region in the country but it is the largest region in Sweden in terms of land area, covering more than one-third of Sweden's land area (37%, 151 929 square kilometres). Upper Norrland's population density is 3.4 inhabitants per square kilometre, far below the national average of 24.54 inhabitants per square kilometre.

Despite the low density, Upper Norrland's demographic patterns, as in Sweden, are relatively more concentrated in comparison to other OECD regions. According to the geographic concentration index applied to all OECD TL3 regions,¹ Sweden records one of the highest concentrations of population in the OECD, just below Portugal (OECD, 2010^[15]). In Upper Norrland, four municipalities (Luleå, Piteå, Skellefteå and Umeå) cover 16.0% of total land area, concentrating 60% of the population.

At the TL3 level, Västerbotten hosted 268 465 inhabitants in 2018, which represent approximately 51% of Upper Norrland's population and 2.7% of the Swedish population. In the past decade, the population grew at an average annual rate of 0.32% compared to the national average of 0.93%. The same year, the

population density of Västerbotten was 4.86 inhabitants per square kilometre, higher than the figure for Upper Norrland (3.4).

The population of Norrbotten was around 251 295 inhabitants in 2018, accounting for approximately 48.4% of Upper Norrland's population and 2.5% of the Swedish population. The share of the female population (48.8%) is slightly higher than in Västerbotten (48.0%) (Statistics Sweden, 2019^[11]). There are 14 municipalities within Norrbotten whose population size range from 76 088 in Luleå to 2 877 in Arjeplog. Its population density is 2.6 inhabitants per square kilometre, which is relatively low compared to the regional and national figure (3.4 and 24.2 respectively). In the past decade, the population experienced a decline (-0.052% annual rate) in contrast with the growth at the national average (0.93%).

Table 2.4. Population by region, capital and municipality, 2018

Region	Capital	Municipalities	Population
Västerbotten (268 465)	Umeå (127 119)	Bjurholm	2 450
		Sorsele	2 522
		Dorotea	2 568
		Åsele	2 819
		Malå	3 122
		Norsjö	4 094
		Vindeln	5 436
		Storuman	5 912
		Vilhelmina	6 752
		Robertsfors	6 762
		Nordmaling	7 118
		Vännäs	8 785
		Lycksele	12 228
		Skellefteå	72 467
Norrbotten (251 295)	Luleå (77 832)	Arjeplog	2 794
		Övertorneå	3 302
		Övertorneå	4 410
		Jokkmokk	5 001
		Pajala	6 039
		Arvidsjaur	6 334
		Älvsbyn	8 140
		Haparanda	9 785
		Kalix	16 058
		Gällivare	17 630
		Kiruna	22 992
		Boden	28 064
		Piteå	42 116

Source: Statistics Sweden (2019^[11]), *Statistical Database*, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_BE_BE0101_BE0101A/?rxid=3a012fe9-414f-47c2-8b84-25feb829e48d (accessed on 5 June 2019).

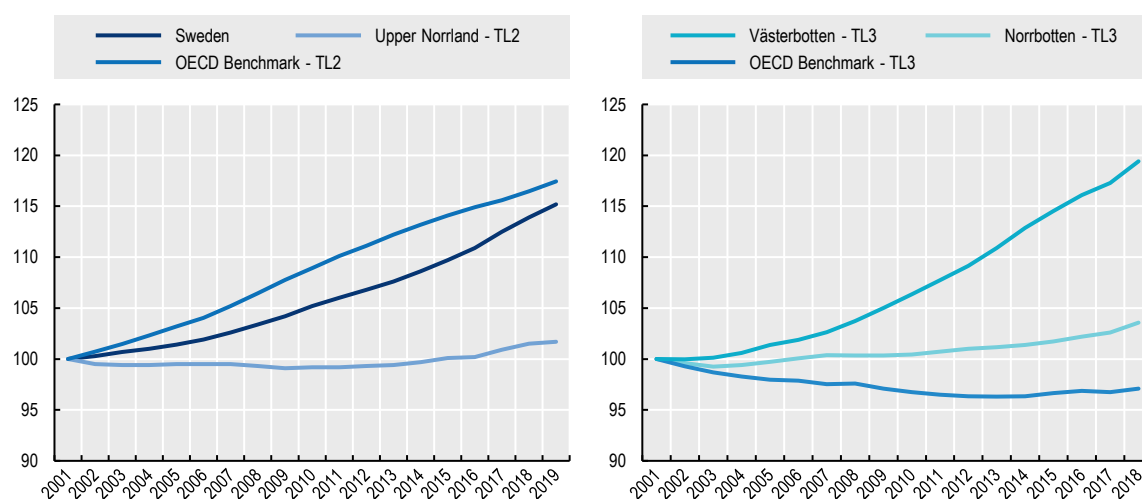
The population of Upper Norrland is shrinking

The population growth in Upper Norrland has been significantly slower than in Sweden and the benchmark TL2 regions. Between 2000 and 2019, the population in Upper Norrland grew 1.7%, which contrast with the population growth rate in Sweden (15.2%) and benchmark TL2 regions (17.5%) during the same period (Figure 2.5).

Within Upper Norrland, the population trend varies across the TL3 regions. While the population in Västerbotten has increased steadily, reaching a total increase of 3.6% between 2000 and 2017, the population in Norrbotten decreased by 2.9% during the same period. The population growth in both TL3 regions has been far below the growth in the TL2 benchmark mining regions (19%) (Figure 2.5). The population growth in Västerbotten has being supported by inflow migration, mainly into the regional capital Umeå (see next section). Within Västerbotten, the population is concentrated in cities, while rural areas face population declines. Between 1990 and 2017, the regional centre of Umeå has increased its share in the region's population from 36% to 46%, while the population share of the 8 inland municipalities of Västerbotten has experienced a decline from 21% to 15%.

In Norrbotten, the population has been decreasing since 1990. The region experienced a total population drop of 5% between 1990 and 2017. During this period, only the 2 main cities, Piteå (5.2%) and Luleå (13.7%) have experienced a net population growth, which resulted in a higher population density in these areas. All of the other 12 municipalities, mostly rural areas, have faced a population drop. Between 2000 and 2017, the population decline has varied between the least affected municipalities that experienced one single drop including Boden (-2.1%) and Kiruna (-5.4%), to municipalities that have lost more than one-fifth of their population, Övertorneå (-21.5%) and Övertorneå (-21.7%).

Figure 2.5. Population growth rate, 2001-18



Note: 2001 = 100.

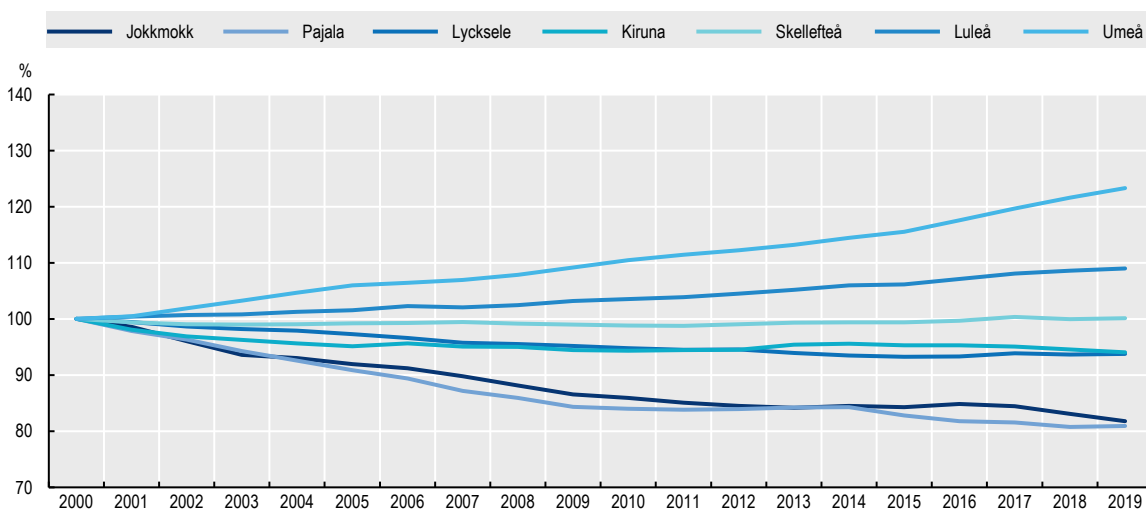
Source: OECD (n.d.^[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

Mining municipalities face a greater population decline than the regional average (Figure 2.6). In terms of gender, there is one constant in all mining municipalities: overrepresentation in favour of men over the total number of young people under 25. On average, across all Upper Norrland municipalities, young women

represent 13.2% of the total population, below the proportion of males (14.5%), with one exception, Umeå, where the gender gap in the young population is almost non-existent.

Between 2000 and 2019, the main mining municipalities in Upper Norrland experienced an average population decline rate of 13.8% (Figure 2.6). In some municipalities such as Pajala, this population has fallen by 19% in this period. This contrasts with the performance of the main cities of the region, Luleå and Umeå, whose population increased by about 0.5% during the same period.

Figure 2.6. Population growth in cities and mining municipalities, 2000-19



Note: 2000=100.

Source: Statistics Sweden (2019^[11]), *Statistical Database*, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_BE_BE0101_BE0101A/?rxid=3a012fe9-414f-47c2-8b84-25feb829e48d (accessed on 5 June 2019).

In summary

Upper Norrland is situated in the north of Sweden and is the largest region in the country. Its population is decreasing year by year, at a faster pace than in Sweden and the benchmark of TL2 mining regions. The negative demographic trend in Upper Norrland is mainly explained by the population decline in Norrbotten (-3%) – especially women – that contrasts with the positive trend in Västerbotten (4%) and the benchmark of TL3 mining regions (19%). This effect is further aggravated when we look at the mining municipalities, where the rural exodus is a tangible reality; the big cities such as Luleå and Umeå are receiving a large part of the population that migrates, especially at working age.

Economically speaking, its activity revolves around its five LLMs, located in the regional capitals of Luleå and Umeå, and around the specialised mining municipalities of Gällivare, Kiruna, Pajala and Skellefteå. Its economic activity is based on extractive and mining activities, concentrating 9 of the 12 active mines in Sweden and providing much of the income for the local population.

Upper Norrland faces outmigration of young population

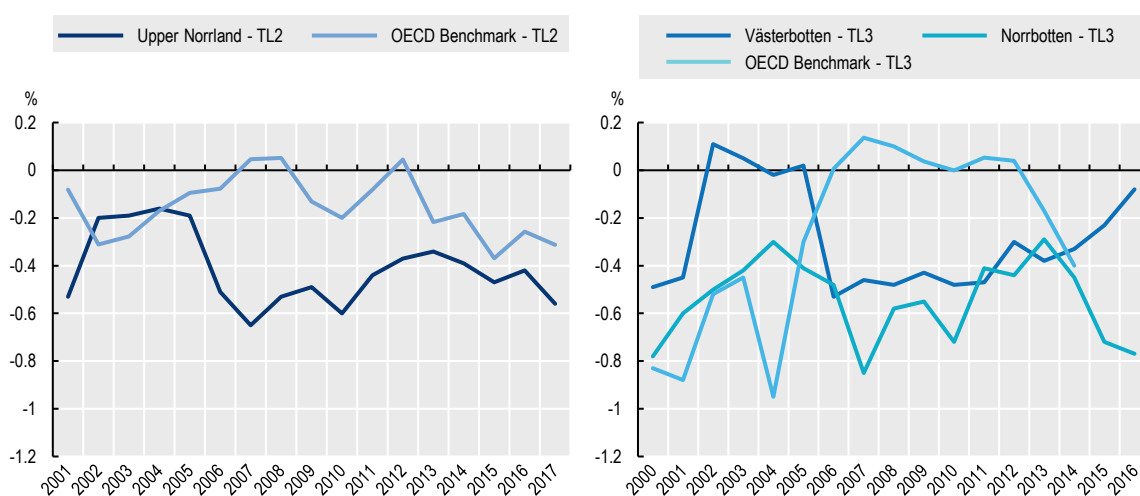
Upper Norrland has been the largest net emitter of migrants to other regions in Sweden, mainly of persons below 30 years old. Between 2001 and 2018, inward migration to Upper Norrland (persons coming from other Swedish regions) was 159 660 individuals, while outward migration (people leaving for other regions of Sweden) was 198 386, for a net stock of 38 726 people leaving the region, or 7.5% of the total population

(Figure 2.7). Of the people leaving Upper Norrland, 60% are aged between 15 and 29 years old. While the phenomenon of negative net migration is common across OECD rural regions (OECD, forthcoming^[3]), the net amount of people leaving Upper Norrland is the highest across all Swedish regions (followed by Central Norrland with 7% of its population) and above the level experienced by the TL2 region benchmark region (2.6% of the population during 2001 and 2017).

At the TL3 level, during the last 20 years, Västerbotten and Norrbotten have been also net emitters of migrants to other Swedish regions (Figure 2.7). However, the trend in Västerbotten has improved in recent years, getting closer to a balance between inward and outward migration. In 2019, this region received 1 204 new residents from other Swedish regions. This performance is better than in the TL3 benchmark regions and in Norrbotten, where net migration from these regions has implied increasing population loss in recent years.

The trend in regional youth migration (under 25-year-olds) is uneven across regions. Between 2000 and 2018, both regions accumulated a negative balance of young people outmigrating to other regions in Sweden. The numbers in Västerbotten (-4 725 people) are substantially lower than Norrbotten (-14 488). However, recent data shows significant trend changes. While in 2018, Västerbotten achieved a positive balance (+15 people) in young people, Norrbotten still experienced outmigration from the region (-1 254 in 2018). A more diversified economy, together with increased attractiveness from prestigious university centres, has made it possible to offer environments that are more prosperous for young people in Västerbotten.

Figure 2.7. Ratio of net migration to the total population, 2000-18

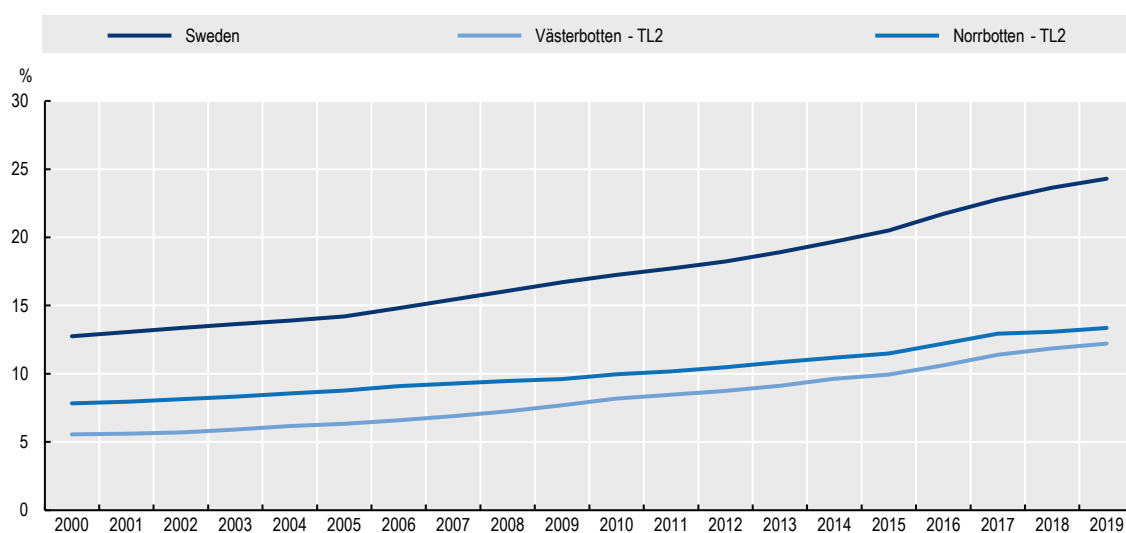


Source: OECD (n.d.^[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

International migration is an important factor to mitigate the regional outmigration in Upper Norrland. Since 2000, both TL3 regions of Upper Norrland have shown a positive trend of the foreign-born population. However, the inflow pace of population is below the need of the region, with a share of the foreign-born population (12%) that is still far lower than the Swedish average (19.8%). From 2001 to 2017, Västerbotten experienced an important growth of international migration (29%), almost twice the growth in Norrbotten (14%).

In 2019, the foreign-born population of Västerbotten represents 10.8% of the total population, equally distributed by gender. During the same year, this figure was positively reinforced by a positive influx of 2 376 international migrants, 35% significantly above other regions of Sweden. In the same year, the foreign-born population in Norrbotten represented 11.8% of the total population, with 1 599 more women than men. In 2019, the region received 2 164 international migrants (slightly lower than Västerbotten), mainly young people 15-35 years old, which helped compensate the outflow of people from Norrbotten to other regions. The share of foreign-born women on Norrbotten's population is 0.8 perceptual points more than in Västerbotten (Figure 2.8).

Figure 2.8. Foreign-born population, ratio, 2000-19



Note: Calculated as the ratio between Swedish and foreign-born population.

Source: Statistics Sweden (2019^[11]), *Statistical Database*, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_BE_BE0101_BE0101A/?rxid=3a012fe9-414f-47c2-8b84-25feb829e48d (accessed on 5 June 2019).

Despite the positive trend of international migration to Upper Norrland, the influx of new people was threatened by the COVID-19 crisis posing an uncertain outlook in the medium term. In the early stages of the health crisis, countries adopted policies to restrict the mobility of their citizens. This implied a drastic contraction in the movements of individuals between countries, with a consequent impact on the migration flows of all countries in the world.

One of the great challenges for the region is to increase its fertility rate. Västerbotten (1.67) and Norrbotten (1.71) is below the minimum fertility value (2) needed to maintain a natural year-to-year replacement. In 2019, Västerbotten had 2 934 births, while it lost population by death in 2 622 individuals, maintaining a positive balance as in the last 15 years. In a different way, Norrbotten lost 2 840 people in the same year, only replaced by 2 457 births, not being able to staunch the negative trend of the last decade (7 853 individuals accumulated since 2000).

In summary

As in many rural areas, Upper Norrland has difficulty retaining its population, especially young people. In fact, Upper Norrland is the largest emitter of migrants to other regions in Sweden, mainly of persons below 30 years old. International migration has helped mitigate the population decline but the region needs to

accelerate the intake of foreign skilled people. Upper Norrland's share of the foreign-born population is half the level in Sweden, highlighting the region's difficulty in attracting and retaining newcomers.

However, the net migration trend in Västerbotten has improved in recent years, with a current positive balance, in comparison with Norrbotten and the trend of TL3 benchmark mining regions. However, the coronavirus crisis has particularly affected international immigration, which may imply a lower trend of migration inflows to Upper Norrland, like other regions, over the short and medium terms. In the aftermath of the crisis, this trend can change and a shift of society and policy preferences towards greater use of remote and virtual working can favour inflows of workers to remote rural regions, associated with longer stay for tourists combining work and leisure or an increase in nomadic workers.

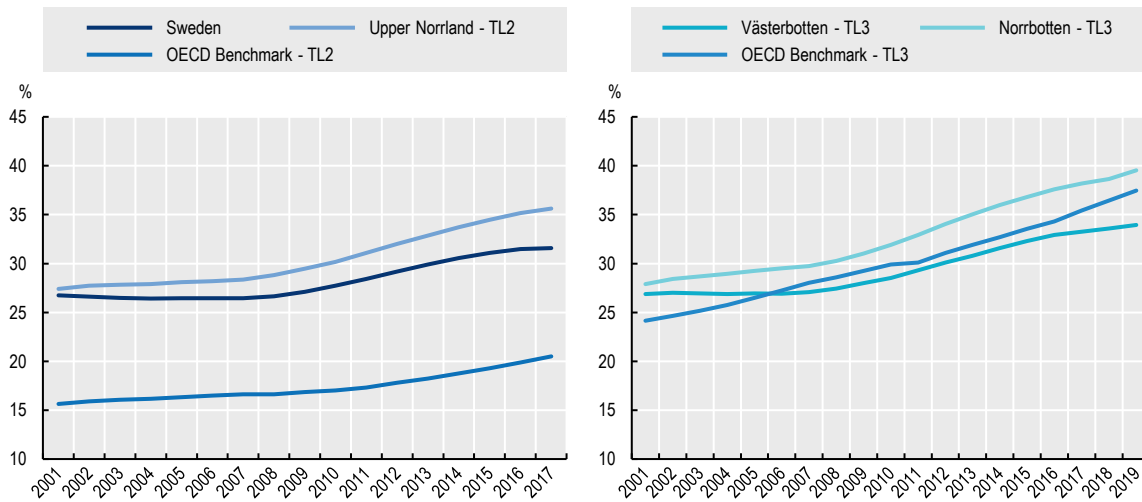
Ageing is an increasing trend in Upper Norrland

The stagnation of population has led to a change in the age structure in Upper Norrland. Between 2001 and 2017, the elderly dependency ratio (the share of population above 65 years old over the working-age population) in Upper Norrland has increased from 27.4% to 36.6% (9.2 percentage points), above the increase in Sweden (from 26.7% to 31.6% - 5.2 percentage points). In 2019, the elderly dependency ratio of Upper Norrland, as for Sweden, is far above the ratio of the TL2 benchmark regions (20.5%) (Figure 2.9). In other words, while the average age of the population in Sweden has increased by 1 year (40 to 41 years old) over the last 20 years, in Upper Norrland, this ageing has occurred twice as fast, with an average age increase of 2 years (40-42 years old) during the same period.

Within Upper Norrland, the population of Norrbotten is ageing faster than in Västerbotten. The elderly dependency ratio in Norrbotten (39.5% in 2019) is 6 percentage points over Västerbotten and 7.5 over the national ratio (Figure 2.9). Between 2001 and 2019, the young dependency ratio (the share of population below 15 years old over the working-age population) in Upper Norrland fell from 28.6% to 25.4%, at a much faster pace than the national average which remains constant at 28.5% (Figure 2.10). In 2001, Upper Norrland had about 92 762 young residents aged 0-14, whereas, in 2019, the youth population decreased to 84 131.

The fall of the share of young population has been particularly severe in the case of Norrbotten. The young dependency ratio in the region falls from 27.8% in 2001 to 25.5% in 2019. This figure represents a lower share of young people than in Västerbotten (25.8% on average since 2001) and relatively higher than the TL3 benchmark regions (22.1%).

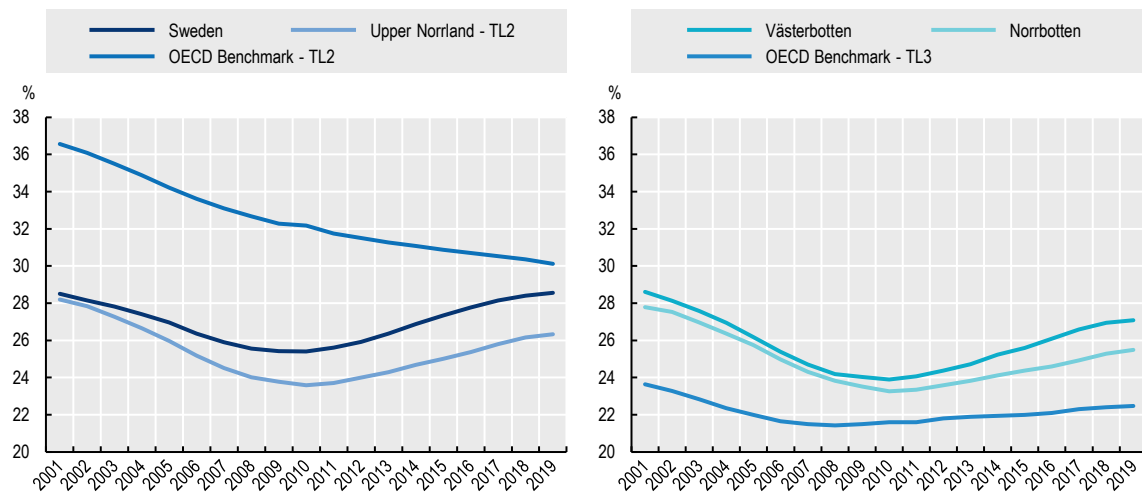
Figure 2.9. Elderly dependency ratio in Swedish TL2 and TL3 regions, 2001-19



Note: Calculated as a share of individuals over 65 years old over the working-age population (15-65 years old).

Source: OECD (n.d.^[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

Figure 2.10. Youth dependency ratio in Swedish TL2 and TL3 regions, 2001-19

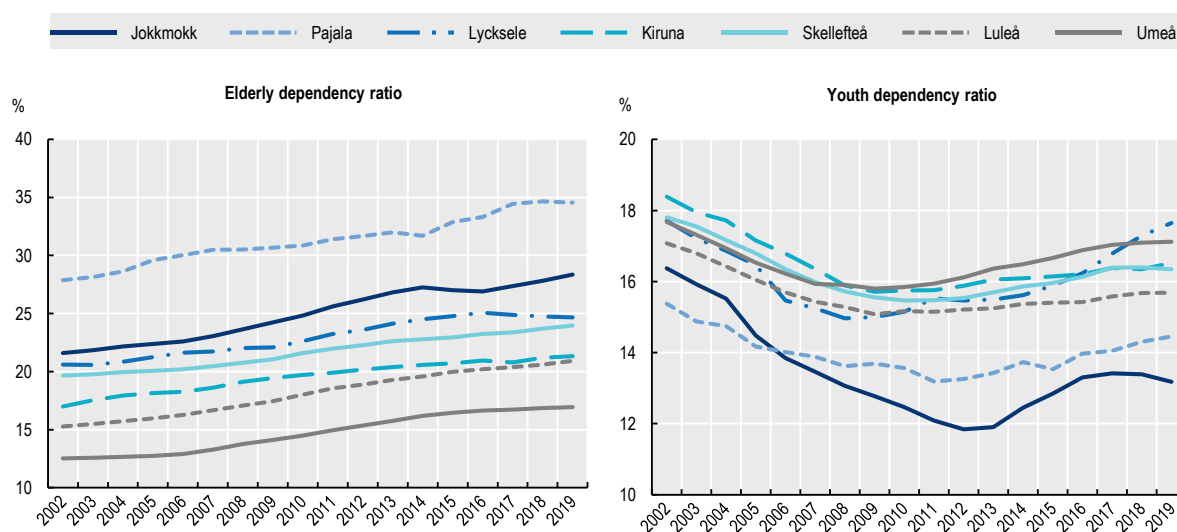


Note: Calculated as a share of individuals over 15 years old over the working-age population (15-65 years old).

Source: OECD (n.d.^[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

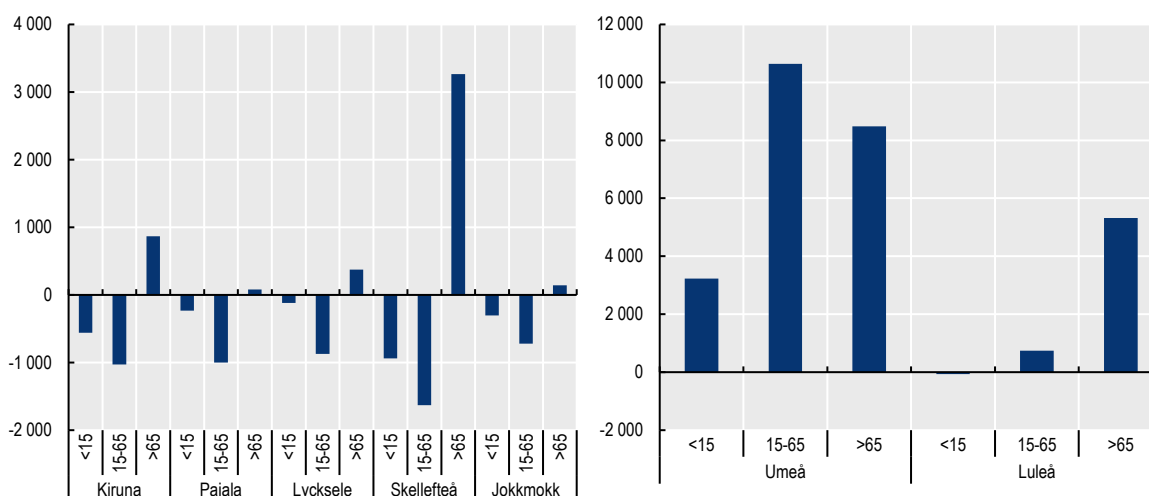
At the municipal level, mining municipalities are ageing faster than the core urban municipalities like Luleå and Umeå (Figure 2.11). For example, in 2019, Pajala's elderly dependency ratio (35%) has reached almost twice the level in Umeå (17%) and Luleå (21%). Since, both cities have attracted young people and middle-aged immigrants, so its elderly dependency has been reduced and its young people are more likely to stay. As depicted in Figure 2.12, between 2002 and 2019, Upper Norrland's mining municipalities have experienced a faster decline in the young and working-age population, in contrast with the trends in urban centres.

Figure 2.11. Youth and elderly dependency ratio, cities and mining municipalities, 2002-19



Note: Calculated as a share of individuals over 65 and below 15 years old over the population 15-65 years old.
 Source: OECD (n.d._[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

Figure 2.12. Population change by age in mining municipalities and cities, 2002-19



Note: Net growth in the number of individuals. The graph on the left refers to the mining municipalities and the one on the right to the cities.
 Source: Statistics Sweden (2019_[11]), *Statistical Database*, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_BE_BE0101_BE0101A/?rxid=3a012fe9-414f-47c2-8b84-25feb829e48d (accessed on 5 June 2019).

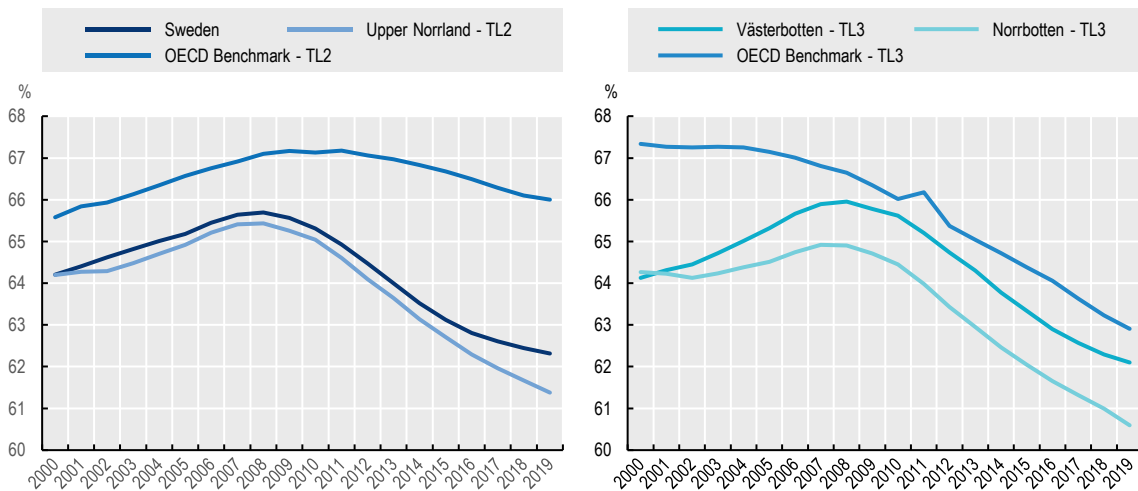
The ageing population and local demographic decline have led to a shrinking of the working-age population in Upper Norrland (Figure 2.13). Before the crisis, Upper Norrland's share of the working population was very similar to the figure of Sweden, 64.2% and 65.5% respectively between 2001 and 2007. However, after the crisis, Upper Norrland's working-age population experienced a rapid decline, much faster than in Sweden and the TL2 mining region average. By 2019, the working-age population in Upper Norrland

represents a large share of the total population (61%), 0.9 perceptual points lower than in Sweden and 4.6 perceptual points than the average of TL2 benchmark regions.

At the TL3 level, Norrbotten has faced a more acute decline of the working-age population than Västerbotten. While both regions had a similar share of working-age population in 2000, the gap widened in favour of Västerbotten throughout the last two decades. In 2019, the share of the working-age population of Norrbotten (60.6%) is 1.5 perceptual points above the level of Västerbotten (62.1%). When comparing with other regions, the two TL3 regions of Upper Norrland have experienced a decrease in their working-age population as compared to the benchmark of TL3 mining regions. A small and decreasing workforce is not only a challenge for the sustainability of the current economic activity in the region but also hampers the growth of new businesses and the financial revenue of local municipalities (Chapter 3).

The sectoral distribution between the genders occurred unevenly. In 2018, the working-age population of Upper Norrland was 47.8% female; however, throughout the 20th century, a process of masculinisation of the mining industry reduced working opportunities for women (Abrahamsson et al., 2014^[17]). Nonetheless, in the last years, old workplace cultures and worker identities have been changing, driven by emerging technologies and companies' efforts to increase gender balance in their workforce (Eveline and Booth, 2003^[18]). Due to the changing demand for skills and the possibilities offered by new technologies and automation, very different types of people and competencies will likely be hired in the future.

Figure 2.13. Working-age population in Swedish TL2 and TL3 regions, 2001-19



Note: Share of the working-age population (15-64 years old) over the total population.

Source: OECD (n.d.^[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

In summary

Overall, Upper Norrland's drop in population is explained by outmigration coupled with the structural ageing of its population, which has resulted in a decreasing workforce over time. The net amount of people leaving Upper Norrland is the highest across all Swedish regions and above the level experienced by the TL2 region benchmark region. It is driven by outmigration of the young population, particularly women. Further, its elderly dependency ratio has been increasing relatively rapidly, reaching levels above the national average and the TL2 benchmark regions. In particular, Norrbotten is experiencing higher outmigration and population ageing than in Västerbotten and the benchmark of TL3 mining regions. In mining communities,

the situation is more severe: these are ageing faster and losing more population than core urban municipalities such as Luleå and Umeå. Therefore, since the financial crisis, the working-age population has declined in the region at a faster pace than in Sweden and TL2 benchmark mining regions. This phenomenon has occurred similarly in both TL3 regions, yet Västerbotten has experienced a less rapid workforce decline. The challenge for Upper Norrland during and after the COVID-19 crisis lies in retaining its young population and attracting a higher proportion of skilled migrants.

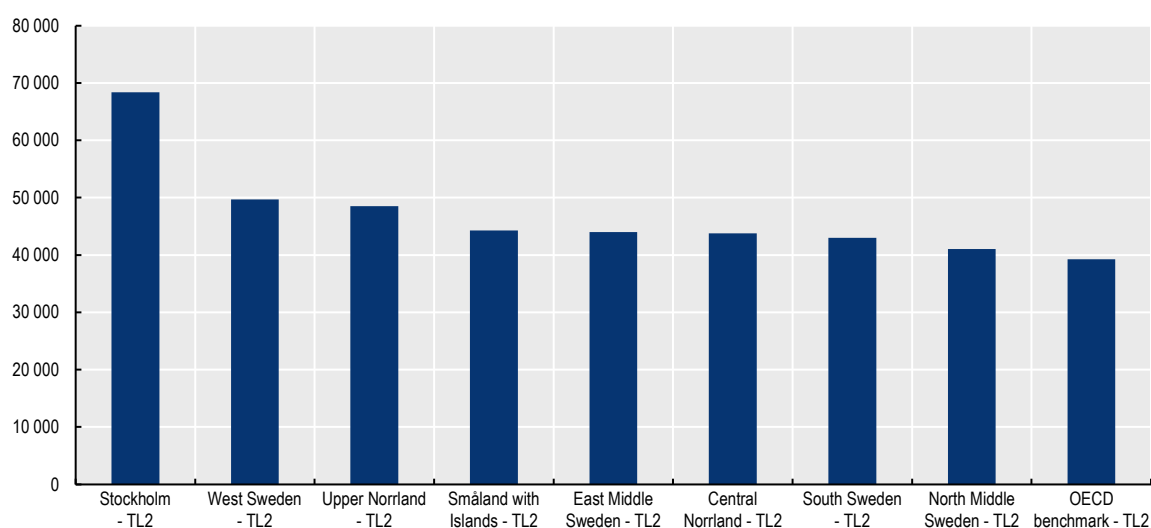
Regional economic trends

Upper Norrland – A high-income region in the Swedish context

The mining industry is a key contributor to the economy of Upper Norrland as well as an engine for regional development. In Upper Norrland, the mining industry has linkages to other industries such as construction, transportation, equipment manufacturing, education and research (Chapter 3). As discussed below (see next section), the volatility of international commodity prices has played an important role in the region's economic performance.

Upper Norrland's GDP per capita is high within the national and OECD regional context. Upper Norrland has the third-highest GDP per capita (USD 44 290) across the 8 TL2 regions in Sweden, right after Stockholm (USD 68 872) and West Sweden (USD 48 804) (Figure 2.14). Upper Norrland's GDP per capita also ranks slightly above the average of OECD mining region (USD 42 087). In 2017, GDP per capita for Upper Norrland was 98% of the national average (USD 46 546) and 67% of Stockholm, which underlines the large income difference of the Swedish capital with the rest of the TL2 regions.

Figure 2.14. GDP per capita of regions of Sweden compared to OECD TL2 benchmark, 2018



Note: USD per head, constant prices, constant purchasing power parity (PPP), base year 2015.

Source: OECD (n.d.^[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

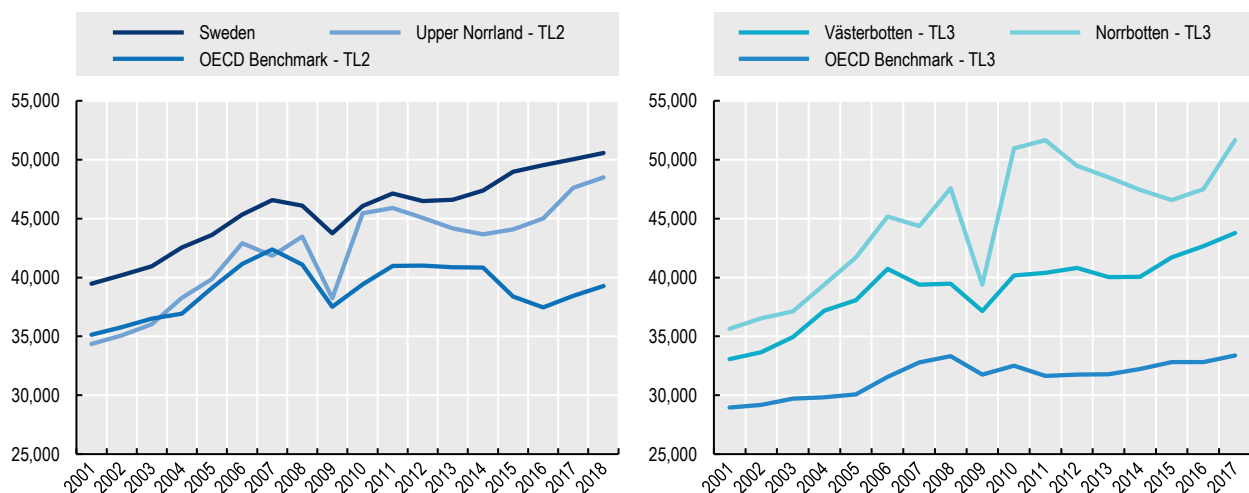
In the last 20 years, Upper Norrland has been closing the income gap with the national average (Figure 2.15). During 2000-17, the gap in the GDP per capita between Upper Norrland and Sweden has narrowed by 22% (from USD 5 097 in 2001 to USD 3 975 in 2017). In the period before the financial crisis

(2000-06), Upper Norrland's economy experienced a constant acceleration with a much faster growth rate (5% annual average) than the national average (3%), mainly driven by high global demand of minerals and industrial products. During the crisis, Upper Norrland's GDP per capita experienced a sharp drop, which ranked Upper Norrland as the TL2 region in Sweden with the largest decline during 2007-09 (-4% annual average vs -2% annual average across Sweden regions). However, in the post-financial crisis era, the Upper Norrland economy quickly recovered above the mining regions' TL2 benchmark, demonstrating its higher labor productivity following the surge in international commodity prices. On average during 2010-17, the region registered the largest GDP per capita growth (3.0% annual average) across Swedish regions (average growth of 1.8%) and exceeded the average growth of OECD TL2 mining regions (0.4%). It is worth noting that Upper Norrland has been expanding its GDP per capita gap with respect to the OECD TL2 mining regions, which underlines the high productivity level in the region (see next section).

At the TL3 regional level, the fall during the crisis and subsequent recovery did not occur equally. During the pre-crisis period, in 2000-06, the economy of Norrbotten and Västerbotten grew at similar rates. However, in 2009, Norrbotten experienced a record decrease (-18% annual rate), plunging its GDP per capita to 2003 levels. In contrast, the decrease of Västerbotten's economy in 2009 (-7%) was less than half of Norrbotten, underlining the high vulnerability of the former region. In the post-crisis years, Norrbotten experienced a volatile recovery with a record growth immediately after the crisis (29% annual growth), followed by a deceleration trend in the subsequent years. Västerbotten's recovery was instead less volatile, with steady economic growth (Figure 2.15).

The strong recovery of the mineral prices after the crisis has allowed Norrbotten's economy to expand the gap with Västerbotten. By 2015, Norrbotten's GDP per capita was 12% above that of Västerbotten, expanding the gap with respect to the beginning of 2000s (8%). However, Norrbotten has proven to be more vulnerable to external shocks, which makes its economic growth trend susceptible to facing larger shocks than its neighbouring TL3 region.

Figure 2.15. GDP per capita trend in Swedish TL2 and TL3 regions, 2001-18



Source: OECD (n.d._[16]), "Regional Demography", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2019).

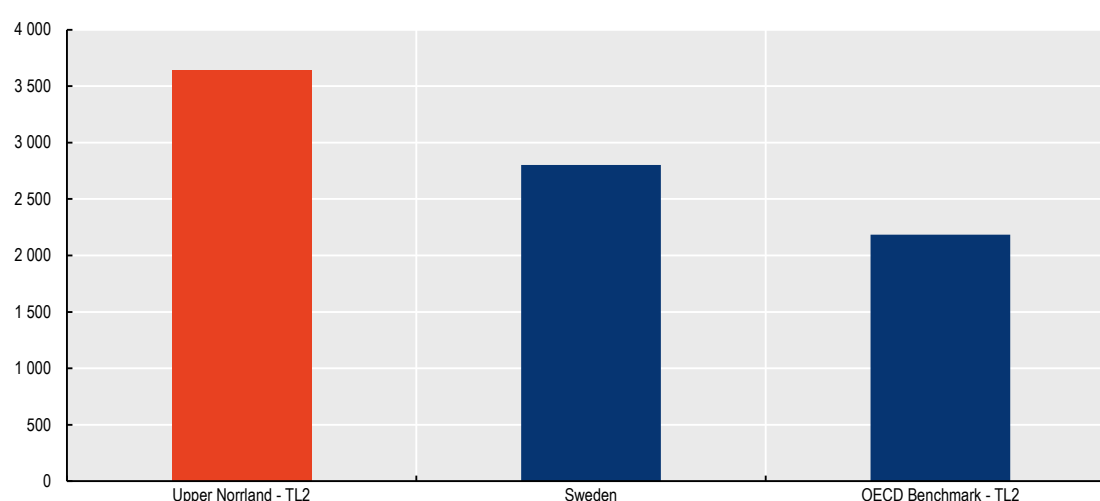
Upper Norrland is vulnerable to external economic shocks

The relatively high dependence on the mining sector exposes these regions to external economic shocks. Regional economies that are heavily dependent on mining tend to be exposed to higher volatility related to changes in international commodity price (OECD, 2017^[1]). The price of commodities has experienced high fluctuations during the crisis and post-crisis period, which has translated in volatilities in Upper Norrland's GDP. Since 2001, its GDP has experienced higher volatility (USD 3 640 standard deviation) than for Sweden (USD 2 800) and the benchmark of TL2 mining regions (USD 2 185) (Figure 2.16). In the last decade, the proximity between the positive and negative peaks seems to indicate the great fluctuation of GDP and its dependence on the value of commodities.

The vulnerability to external shocks is not the same within the two TL3 regions, as Norrbotten's economy has faced higher volatilities than Västerbotten's. Between 2001 and 2016, Norrbotten's GDP experienced higher volatility (USD 4 963 standard deviation) than Västerbotten (USD 2 600). This is mainly explained by the higher dependency of Norrbotten's economy on the mining industry and related activities. Norrbotten's GDP follows more closely the volatility of international prices of copper and iron ore. When the price of these metals reached a peak during 2006, 2008 and 2010, the GDP growth in Norrbotten experienced the highest values of the decade. Similarly, the negative peaks of prices in 2007, 2009 and 2012 coincided with the lowest values of GDP growth in Norrbotten since 2002.

A similar effect occurred in the TL2 benchmark, with sharp falls in 2007 and 2008. Reducing such volatility should be of interest to the entire Upper Norrland area in order to ensure sustainable and sustained growth (Chapter 3). This will be especially important in the context of the recent 2020 coronavirus crisis, which may once again highlight the vulnerability of the Upper Norrland economy to external shocks. As the chapter explains, the high dependence of its economy on mining and extractive activities may aggravate the effects of COVID-19 over time, as mining has been one of the first sectors most affected by the global slowdown. This is partly explained by the fact that the major importers of mineral materials have dramatically reduced their activity, consequently affecting suppliers. The spearhead has been China, where the reduction of the manufacturing and construction sector has implied the diminishing demand for mineral materials.

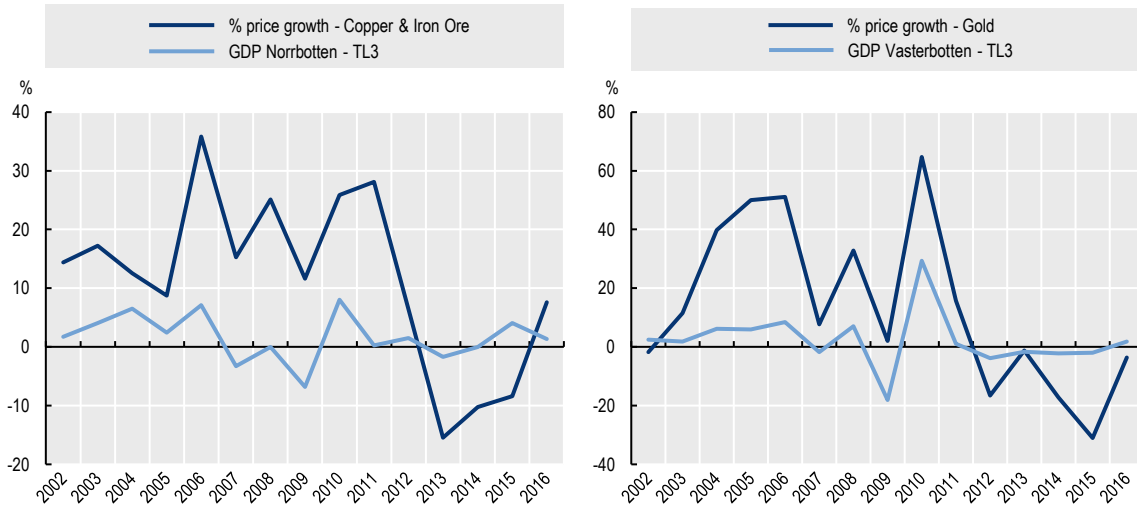
Figure 2.16. Standard deviation of GDP, Sweden and Upper Norrland regions, 2001-16



Note: Standard deviation calculated with USD per capita, constant prices, constant PPP and base year 2015.

Source: GDP per capita: Calculations based on OECD (2016^[19]), *OECD Regional Statistics (database)*, <http://dx.doi.org/10.1787/region-data-en> (accessed 20 February 2020).

Figure 2.17. GDP growth rate in Västerbotten and Norrbotten vs. international commodity prices, 2002-16



Note: Copper and iron ore prices are calculated as their average prices. GDP growth rate uses per capita GDP, current PPP.
 Source: (International Monetary Fund, 2020_[20]) GDP per capita: OECD (2016_[19]), *OECD Regional Statistics (database)*, <http://dx.doi.org/10.1787/region-data-en> (accessed 20 February 2020).

In summary

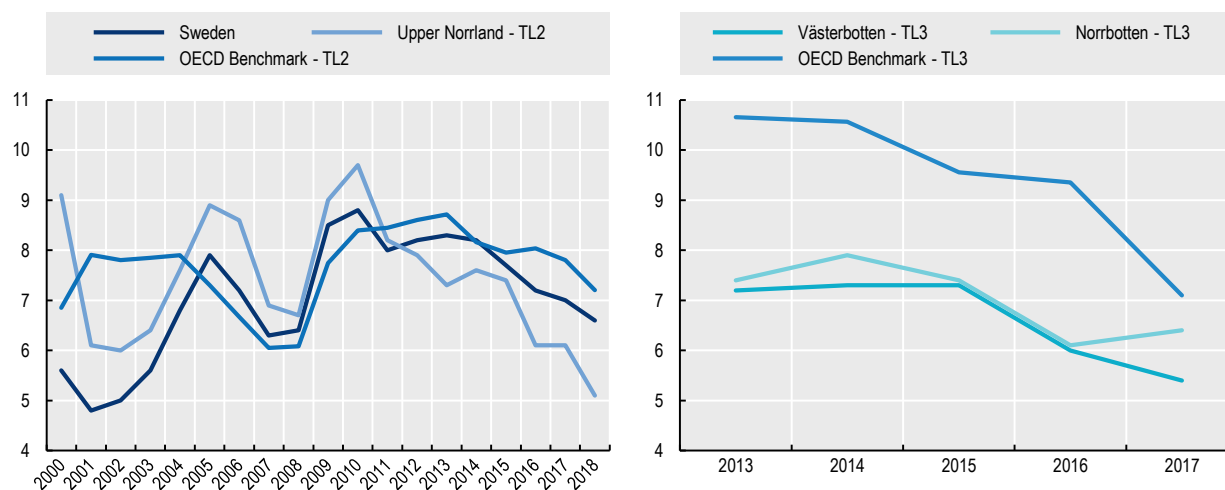
Upper Norrland has the third-highest GDP per capita in Sweden as well as a low unemployment rate allowing the region to reduce its income gap with the rest of the country by 22% in the last 20 years. After the crisis (2010-17), the region registered the largest GDP per capita growth (3% annual average) across Swedish regions and widened its GDP per capita gap with the TL2 benchmark. Population decline and a fundamentally industrial economy along with high prices in the international commodity market have enabled Upper Norrland to experience an unstable but strong economic performance. However, this dependence on international commodity prices has generated a very volatile economy.

At the TL3 level, Norrbotten has proven to be a more volatile economy that experienced a drastic drop during the crisis, but recovery at a faster pace than Västerbotten and the TL3 benchmark. Norrbotten depicts a greater specialisation in mining activities than Västerbotten, which makes it more vulnerable to external shocks. Reducing such volatility should be of interest to the entire Upper Norrland area in order to ensure sustainable and sustained growth.

The unemployment rate is lower than Sweden but is increasing faster

During the post-crisis period, Upper Norrland's unemployment rate has decreased at a much faster rate than in Sweden (Figure 2.18). Before the crisis, in 2007, the unemployment rate was at 6.9%, 0.6 points above the national average. However, the stronger recovery after the crisis helped Upper Norrland's economy to reduce its unemployment rate from 9% in 2009 to 5.1% in 2018. This reduction is 2 perceptual points larger than at the national level (from 8.5% in 2009 to 6.9% in 2019). The relatively better performance on job creation in Upper Norrland has been associated with higher GDP growth after the crisis, the reduction of the workforce and its higher ageing rate. In 2018, the unemployment rate ranks at 5.1%, below the level in Sweden (6.6%) and TL2 mining regions (7.3%).

Figure 2.18. Unemployment rate over labour force in Sweden, Upper Norrland, Västerbotten, Norrbotten and TL2 & TL3 comparable regions



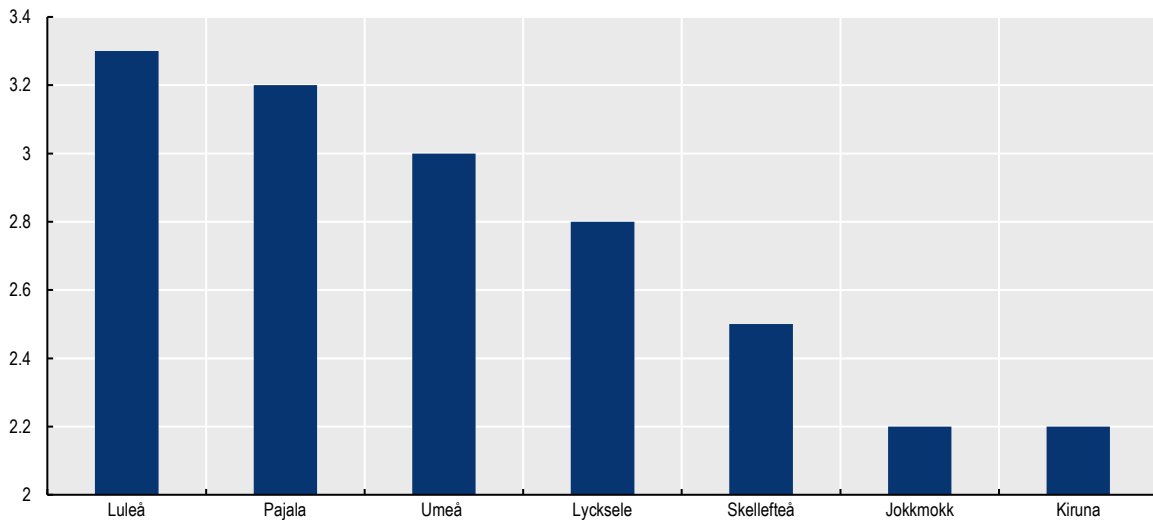
Note: Percentage of unemployed population over labour force 15-64 years old.

Source: OECD (n.d.[21]), "Regional Labour", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

At the TL3 level, Västerbotten exhibits a lower unemployment rate than Norrbotten (Figure 2.18). In 2019, the unemployment rate in Västerbotten (5.5%) was slightly below the level in Norrbotten (6%), with both remaining below the national average (6.9%). Västerbotten had a decline in unemployment that was relatively strong in 2014 but slowed down in 2016 and 2017.

In 2020, the changing working habits and the emergence of digital solutions in response to the COVID-19 crisis called for greater efforts to adapt to the elderly and the workforce to technological changes. Older workers and the elderly population were especially disrupted by new methods of work. Mining communities with an older workforce, a lower share of the service economy and a reliance on economic activities that depend on the physical presence of workers are being more vulnerable to the effects of the crisis.

At the municipal level, mining municipalities tend to benefit from a lower unemployment rate than the urban centres of the region. In Norrbotten, Luleå's unemployment rate in 2019 was 3.3%, above the level in Pajala (3.1%) and much higher than in Jokkmok (1.9%) and Kiruna (1.8%). Likewise, in Västerbotten, in 2019, Umeå recorded an unemployment rate (3.0%) above the Västerbotten municipal average (2.8%) and the level in the mining municipality of Malå (2.3%).

Figure 2.19. Unemployment in cities and mining regions, 2019

Note: Unemployment rate as a percentage over labour-force population, 2019. The cities are Luleå and Umeå.

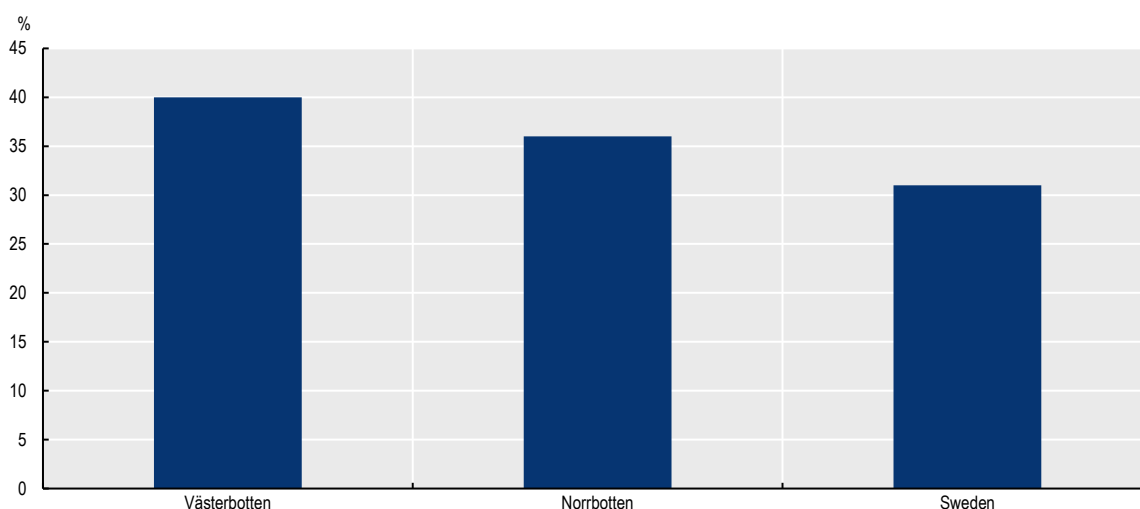
Source: RegionFakta (n.d.^[22]), *Statistics from Counties and Regions in Sweden*, <http://www.regionfakta.com/> (accessed on 15 February 2020).

In the regions of northern Sweden, the public sector is the top employer (Figure 2.20). Health, education and governments constitute important employers in Upper Norrland. A policy agenda to deliver quality public services to the most dispersed settlements has supported the expansion of labour demand in health and education activities across the region. In Upper Norrland, the top three employers by size in 2019 are in the public sector. The fourth-largest employer in Västerbotten is Umeå University while, in Norrbotten, it is the mining company, LKAB, which employs 3 475 people. In Västerbotten, the public sector is a relevant employer, representing 40% of total employees, which is mainly explained by the high cluster of healthcare in the region.

In summary

Like its economy, unemployment in Upper Norrland is highly volatile. Therefore, although its unemployment performance has been better than in the rest of the country over the last 20 years, the reasons are not necessarily positive. This effect is partly explained by the decline in its labour force, which is due to migration and the ageing of its population in the region in a context aggravated by the effects of the post-COVID-19 economic crisis. This unemployment rate decreased in Västerbotten than in Norrbotten. In particular, the rural and mining municipalities have a lower unemployment rate than the region's urban centres.

Figure 2.20. Share of employment in the public sector in Upper Norrland's regions compared to Sweden, 2015



Note: Share calculated as a percentage over total employment.

Source: OECD (2017^[23]), *OECD Territorial Reviews: Northern Sparsely Populated Areas*, <https://doi.org/10.1787/9789264268234-en>.

Upper Norrland is highly specialised

At a national level, Upper Norrland's economy is dominated by industrial activities (including energy and mining) linked to the natural resources (Table 2.5). The share of industrial activities on mining and energy (11.5%) are particularly much higher than the national level (3.3%) but slightly below the average of TL2 regions (13.4%). Together with manufacturing activities, also linked to the processing of natural resources like forestry, the industrial sector in Upper Norrland (26.3%) is much higher than the national level (18.8%) and similar to the benchmark of TL2 regions (26.3%). As much of these activities are export-oriented, the regional economy benefits from a higher share of tradeable activities than at the national level. This is positive, as productivity in tradeable activities tends to be larger than in non-tradeable activities across OECD countries and regions (OECD, 2019^[24]; 2016^[25]). However, services represent just a small share of the tradeable sector (9% vs. the national average of 15.7%), which can limit the gains from international trade as services tend to be linked with higher-value-added activities in GVCs (OECD, 2019^[24]; 2016^[25]).

Table 2.5. GVA share by sector in Sweden, Upper Norrland and OECD TL2 benchmark, 2015

	Sweden	Upper Norrland - TL2	OECD benchmark -TL2
GVA in agriculture, forestry and fishing	1.4	2.8	1.9
GVA in mining, industry and energy	3.3	11.5	13.4
GVA in manufacturing	15.5	14.3	12.9
GVA in construction	5.8	7.3	6.7
GVA in distributive trade, repairs, transport, accommodation, food service activities	18.0	15.7	19.8
GVA in information and communication	7.7	3.9	3.1
GVA in financial and insurance activities	4.6	2.1	4.8
GVA in real estate activities	8.4	5.9	9.9

	Sweden	Upper Norrland - TL2	OECD benchmark -TL2
GVA in professional, scientific, technical activities, administration, support service activities	11.2	7.9	11.5
GVA in public administration, compulsory social security, education, human health	21.2	25.7	19.0
GVA in other services	3.0	2.8	3.2

Note: Tradeable sectors are defined by a selection of sectors defined in the System of National Accounts (SNA) 2008. They include agriculture, industry and manufacturing, information and communication, financial and insurance activities, agriculture and other services.

Source: OECD (n.d.^[26]), "Regional Economy", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

Upper Norrland is creating SMEs but at a slower pace than the country

Inside Upper Norrland, Norrbotten depicts a greater specialisation in mining activities than Västerbotten (Table 2.6). In terms of both employment and GVA, the local quotient of specialisation in Norrbotten (4.0) doubles the level of Västerbotten (2.0). In contrast, Västerbotten is more specialised in manufacturing (1.2), while the Norrbotten quotient of specialisation (0.7) reveals the lower weight of this sector in the regional GVA. Other sectors of specialisation in terms of GVA for both regions are agriculture, forestry and fishing, construction and public sector (education, health).

Table 2.6. Specialisation Index by sector in Västerbotten and Norrbotten, 2015

	Västerbotten		Norrbotten	
	Employment	GVA	Employment	GVA
Mining, including energy	2.3	2	4.2	4
Agriculture, forestry and fishing	1.4	2.2	1.5	1.9
Manufacturing	1	1.2	0.7	0.7
Construction	1.1	1.1	1.3	1.4
Distributive trade, repairs, transport, accommodation, food service activities	0.8	0.8	0.8	0.9
Information and communication	0.8	0.5	0.6	0.5
Financial and insurance	0.4	0.5	0.4	0.4
Real estate	1	0.8	1	0.6
Professional services	0.7	0.7	0.8	0.7
Public admin., compulsory social security, education, human health	1.2	1.2	1.2	1.2
Other services	0.8	1	0.8	0.9

Note: The location quotient for each sector is the ratio between the sector weight in regional GVA/employment, and the weight of the same sector in national GVA/employment. A value above 1 implies that the region is more specialised in that sector than the rest of the economy. GVA based on USD PPP constant values (2010). Upper Norrland is creating SMEs but at a slower pace than the country.

Source: OECD (n.d.^[26]), "Regional Economy", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

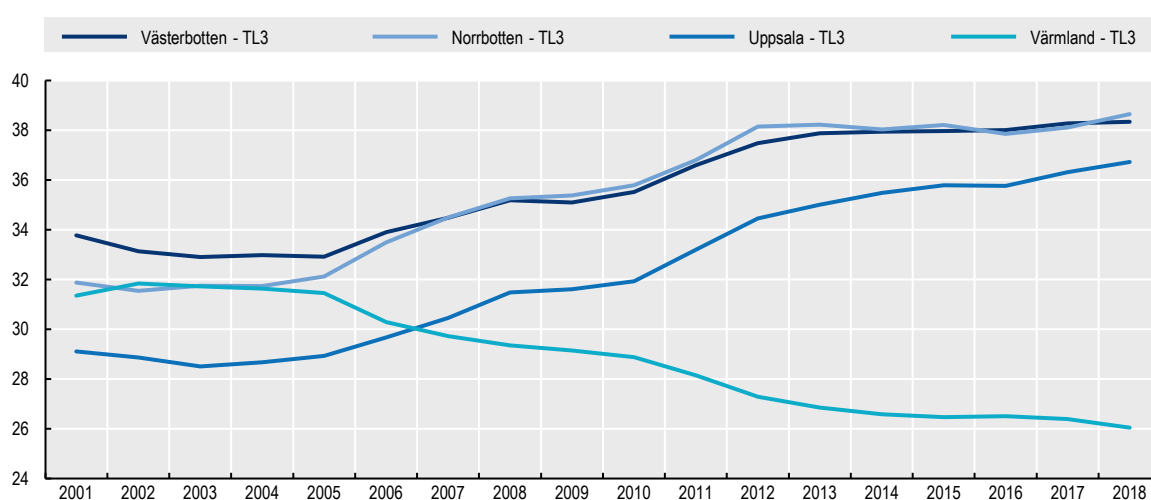
In summary

Upper Norrland has the necessary characteristics to be described as a specialised region; a high GVA share and high level of employment dedicated to one specific sector. Mining occupies the highest level of employment, and likewise, the highest GVA share. It is not the same in both regions of Upper Norrland, because, while Västerbotten (2) has a more diversified economy, its GVA share in mining is half that of Norrbotten (4).

The number of companies in the region is relatively high but growth has stagnated

Upper Norrland has a high number of companies in relation to its population but the creation of new companies has been falling behind the country performance. Västerbotten and Norrbotten have a similar density of businesses with 39 companies per 1 000 inhabitants, similar level of other TL3 regions in Sweden (Figure 2.21). However, since the financial crisis, the creation of businesses has been decreasing in relation to the national dynamic (Figure 2.22). The share of companies in Västerbotten and Norrbotten within the total number of Swedish companies has experienced a constant decrease from levels of 3.1% and 2.9% in 2000 to 2.5% and 2.4% in 2019 respectively. The reason for this drop in the creation of establishments can be associated with a lower population, a low unemployment rate and the high reliance on mining activities that hamper entrepreneurship culture.

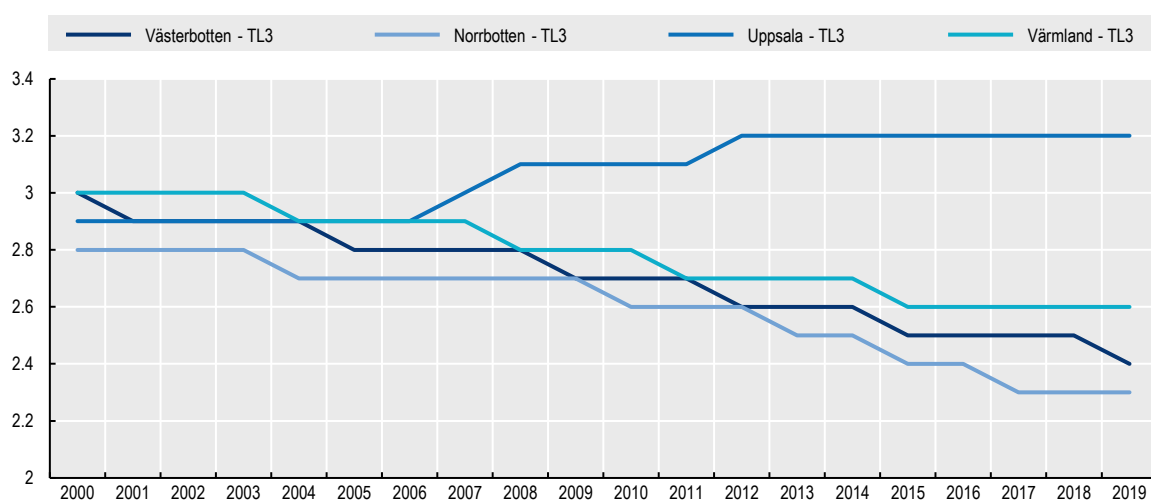
Figure 2.21. Density of business establishment growth, 2001-08



Note: Number of establishments per 1 000 citizens.

Source: RegionFakta (n.d.^[22]), *Statistics from Counties and Regions in Sweden*, <http://www.regionfakta.com/> (accessed on 15 February 2020).

Figure 2.22. Share of regional business establishments at the national level, 1998-2019



Note: The TL3 region's share of workplaces in the state.

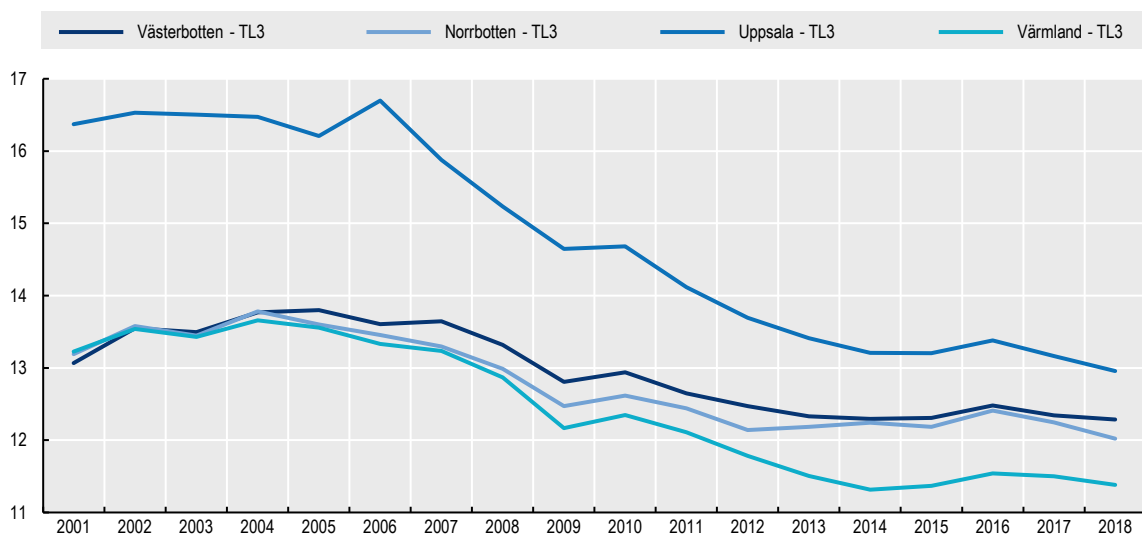
Source: RegionFakta (n.d.^[22]), *Statistics from Counties and Regions in Sweden*, <http://www.regionfakta.com/> (accessed on 15 February 2020).

The average size of business establishments in Upper Norrland has remained relatively constant. Norrbotten and Västerbotten have relatively similar sizes of business. On average, companies in both regions have around 12 employees. While the average size of business establishments in Upper Norrland TL3 regions has declined, this has occurred to a slower pace than other TL3 regions in Sweden (Figure 2.23). This result is coherent with the relevance of mining companies and the public sector as main employers in the regions. It is worth noting that in Upper Norrland mining municipalities, a significant number of small SMEs tend to be family-run or single-owner businesses (Regional Government of Norrbotten, 2019_[27]).

The recent COVID-19 economic crisis has tested the endurance capacity of SMEs. Their financial capacity is small compared to large companies, generally with limited resources and no financial room for manoeuvre. SMEs showed less resilience and flexibility in dealing with the costs these shocks entail. Costs for prevention as well as requested changes in work processes, such as the shift to teleworking, were relatively higher for SMEs given their smaller size but, also, in many instances, the low level of digitalisation and difficulties in accessing and adopting technologies.

Given the limited resources of SMEs, and existing obstacles in accessing capital, the period over which SMEs can survive the shock is more restricted than for larger firms. Therefore, the government and institutional support are crucial in reducing the pressure on SMEs.

Figure 2.23. Average size of business establishments, 2001-18



Note: Average number of employees in business establishments.

Source: RegionFakta (n.d._[22]), *Statistics from Counties and Regions in Sweden*, <http://www.regionfakta.com/> (accessed on 15 February 2020).

In summary

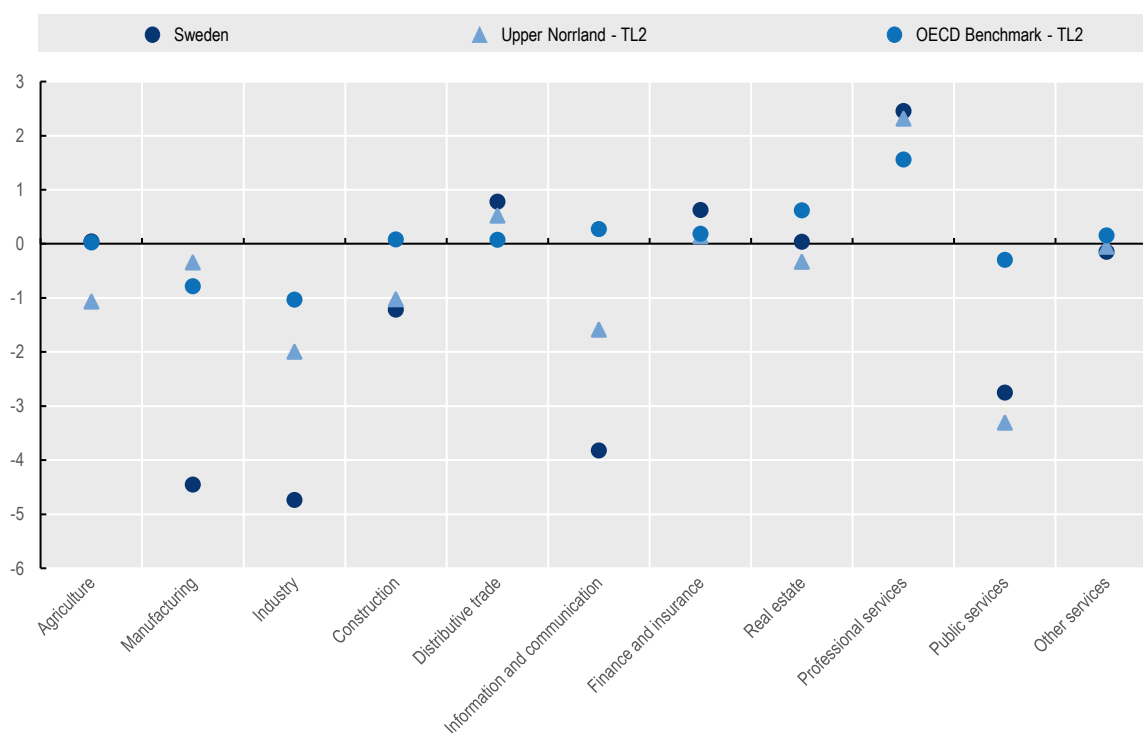
The absolute growth of businesses in Upper Norrland is positive; however, the rate of creation is lower than in the rest of the country. In addition, companies are getting smaller as the number of employees per company is decreasing.

The sectoral trends are changing

During the crisis, the economic sectors in Upper Norrland experienced fewer striking declines showing greater resilience to external effects than the rest of Sweden. However, many sectors in Upper Norrland recovered at a slower pace than in the rest of the country. The manufacturing activities were particularly vulnerable to the effects of the financial crisis in Sweden (-4.45%), relatively higher than in Upper Norrland (-0.35%). A similar effect occurred in industry: the fall in Sweden (-4.74%) was much more significant than for Upper Norrland (-2.00%) (Figure 2.24). Nevertheless, when compared with other mining regions of the TL3 benchmark, the manufacturing sector in Upper Norrland showed a relatively higher vulnerability to the shocks of the financial crisis.

Other areas of specialisation in Upper Norrland in terms of GVA and employment, such as agriculture, forestry and fishing, and construction, responded better to the crisis than at the national level. However, public administration, which is a relevant sector for Upper Norrland, experienced a steeper drop.

Figure 2.24. Change in GVA share, by sector in Sweden, Upper Norrland and OECD TL2 benchmark, 2005-15

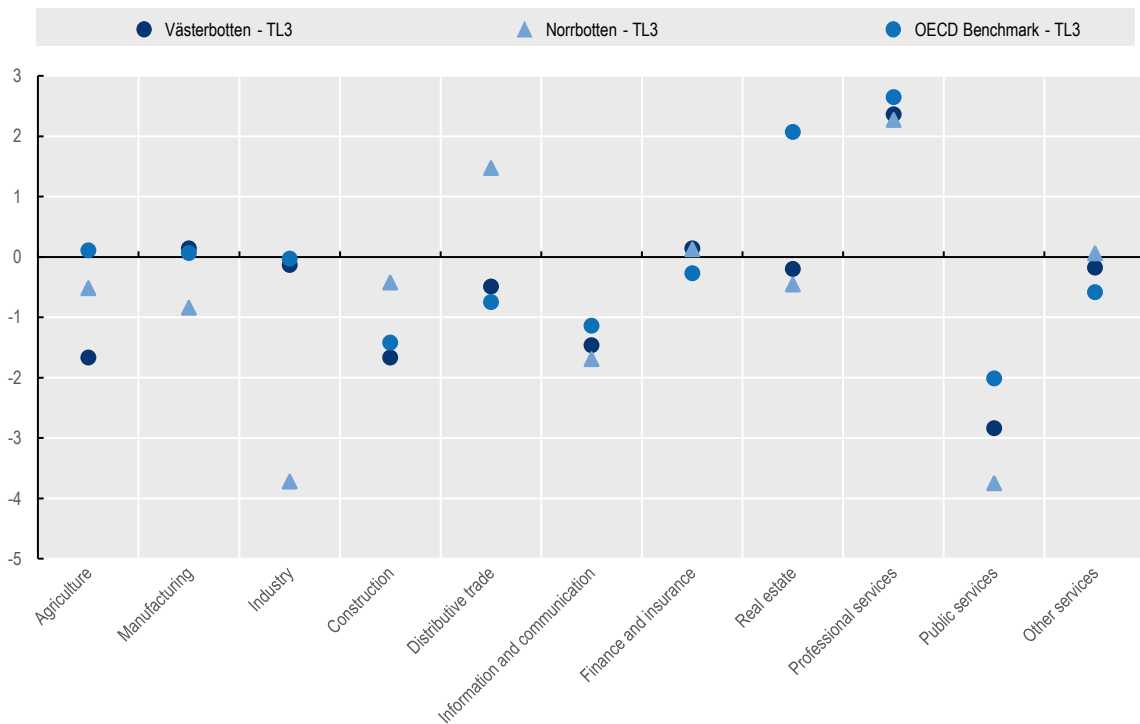


Source: OECD (n.d.^[26]), "Regional Economy", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

The arrival of an economic crisis – following the health crisis due to COVID-19 – affected the economic sectors of Upper Norrland unevenly. In practice, this crisis shared similarities with the financial crisis of 2008. While the Västerbotten region showed more resilience to external shocks thanks to its more diversified economy, the Norrbotten economy is concentrated in fewer sectors, resulting in a more vulnerable economy. The manufacturing and construction sectors were impacted in the early stages of the crisis; however, when the economic situation improved, these sectors rebounded, serving as a trigger for the region's recovery.

At the TL3 level, situations are different for Västerbotten and Norrbotten. In Västerbotten, the economic sectors maintained a higher resilience compared to Norrbotten. In Västerbotten, sectors such as manufacturing (0.14%) and industry (-0.14%) were strongly resistant to the passage of the crisis, unlike Norrbotten (-0.84% and -3.72% respectively) (Figure 2.25). However, other sectors did suffer considerable falls. Public services in Norrbotten (-3.75%) and Västerbotten (-2.84%), as well as information and communication (-1.58% combined), suffered the worst part of the crisis, losing relevance in the GVA share of the region.

Figure 2.25. Change in GVA share, by sector, Västerbotten, Norrbotten and OECD TL3 benchmark, 2005-15



Source: OECD (n.d.^[26]), "Regional Economy", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

Between 2005 and 2015, industry in Upper Norrland experienced a lower decline than in the rest of the country (Table 2.7). During this period, the share of the industry in Upper Norrland's GVA fell 2.0 percentage points, recording a lower decrease than the rest of the country (4.74). Both TL3 regions within Upper Norrland have responded differently to the crisis, where the share of the industry in Norrbotten's GVA experienced a larger decrease (3.72) than Västerbotten (0.14). Västerbotten's industrial resilience responds to a more diversified economy that helped maintain the GVA share of the sector at a similar level than the pre-crisis period.

Table 2.7. GVA share change, 2005-15

	Sweden	Upper Norrland	OECD benchmark - TL2	Västerbotten - TL3	Norrbotten - TL3	OECD benchmark - TL3
Industry	-4.74	-2.00	-1.04	-0.14	-3.72	-0.03

Source: OECD (n.d._[26]), "Regional Economy", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

During the post-2008 crisis period, tourism-related activities were growing following the trend at the national level. In recent year, both regions have maintained a very positive trend, doubling their values from 15 years ago. Norrbotten and Västerbotten have also developed linkages to strengthen the tourism-related activities within the region. Västerbotten is attracting tourism through its nature-based activities related to its lakes and river valleys. Norrbotten has great growth potential as well, benefiting from a wide range of nature-based tourism, especially during summer and winter, with Arctic-related activities (i.e. aurora borealis). Over the last decade, both regions have put greater priority on fostering its tourism offers with tourist attractions such as the aurora borealis, coastal recreation, hiking, camping and the Sami culture.

However, as in many countries, the impact of COVID-19 on international and domestic tourism has been overwhelming and immediate. It has especially affected international tourism throughout 2020, with some effects likely to continue in the medium term. The OECD estimates that the international tourism economy is expected to fall in 2020 between 45% and 70% (OECD, 2020_[28]). Rural communities specialised in travel arrangements, leisure and hospitality were particularly vulnerable to the global slowdown. In the aftermath of the pandemic and while international tourism gradually recovers, domestic tourism has been playing an essential role in Upper Norrland. For this, it will be essential to ensure flight connections, take aggressive, and co-ordinated policy action at the local, national and international levels to minimise job losses and business closures.

Upper Norrland's industrial productivity is high in the national context

In the national context, Upper Norrland has been a strong productivity performer in terms of GDP per worker. The region had a higher level of labour productivity in industrial sectors than Sweden (Table 2.8). Norrbotten's labour productivity in industry and in total is higher than in Västerbotten but both regions are below the TL3 benchmark average.

Upper Norrland's labour productivity has experienced two peak periods in 2005 and 2006 and again in the post-crisis period, 2010 and 2011 (Figure 2.26). Since 2012, labour productivity has diminished. This change followed a constant trend and, in 2015, the labour productivity of Upper Norrland (USD 83 123) dropped to 8 percentage points below the national level (USD 90 330). Since 2000, the productivity gap between Upper Norrland and the national average has decreased slightly. This is partly due to a higher labour productivity growth rate at the national level.

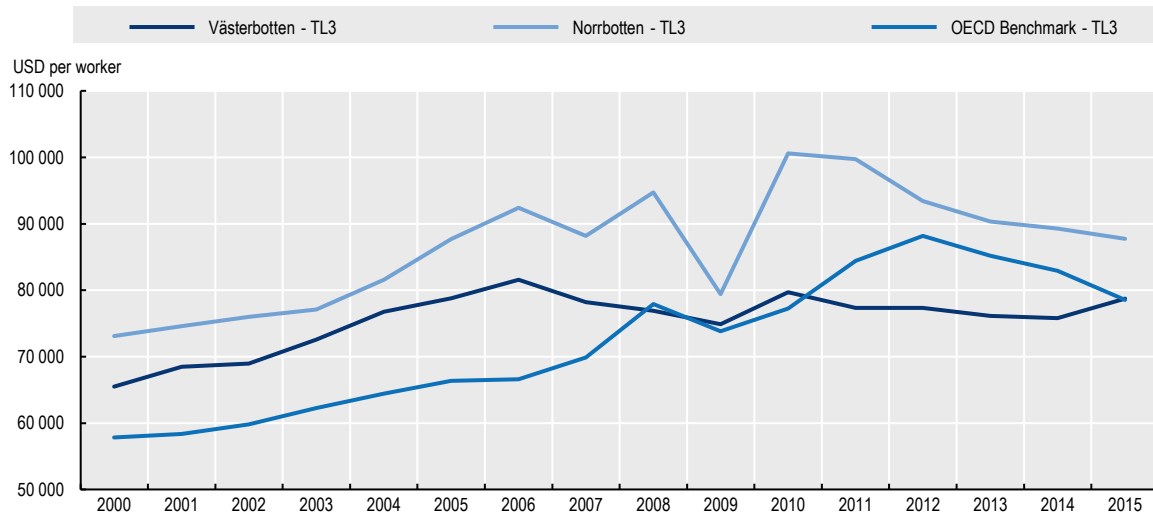
Historically, Norrbotten has been a high-productivity region within Sweden and Upper Norrland. In 2000, Norrbotten (USD 73 126 per worker) was relatively more productive than Västerbotten (USD 65 475 per worker), reaching its lowest difference (6%) in the middle of the crisis in 2009, coinciding with the high volatility of the financial markets. In the post-crisis years (2012-15), the gap has been on average 17%, widening again the difference between Norrbotten and Västerbotten (Figure 2.26).

Table 2.8. Productivity in Sweden, Upper Norrland and its TL3 regions, 2015

	Sweden	Upper Norrland	Västerbotten	Norrbotten
Labour productivity	79 722	73 363	69 480	77 440
Labour productivity in mining and energy	243 812	229 073	187 267	220 238
Labour productivity industry	118 736	141 870	127 153	149 107

Note: Measured as USD per worker.

Source: OECD (n.d.^[26]), “Regional Economy”, <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

Figure 2.26. Labour productivity trend in the TL3 regions of Upper Norrland, 2000-15

Source: OECD (n.d.^[26]), “Regional Economy”, <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

In summary

Upper Norrland has been more resilient to the effects of the crisis than the rest of Sweden. Sectors such as industry and manufacturing have shown relatively constant values over the period before and after both the 2008 and 2020 crises. The greater diversification of Västerbotten on the one hand and the high productivity ratios of Norrbotten on the other make Upper Norrland a resilient but volatile region in the short term.

Enabling factors for development

Snapshot of quality of life in Upper Norrland

Quality of life is important for a remote region like Upper Norrland for retaining and attracting people and business. The OECD’s analysis of well-being at the regional level provides a tool that allows policymakers to assess regional strengths and weaknesses, monitor trends and compare their outcomes to other regions, nationally and internationally (Box 2.3). To better understand the relationship between well-being

and mining regions, the analysis presented in this section adopts the OECD regional well-being framework to compare outcomes of quality of life in Upper Norrland against the average of OECD TL2 regions, the OECD mining regions and Sweden's average.

Box 2.3. OECD Regional Well-being Indicators

Building comparable well-being indicators at a regional scale

The OECD framework on measuring regional well-being builds on the OECD Better Life Initiative at the national level. It goes further to measure well-being in regions with the idea that well-being data are more meaningful if measured where people experience it. Besides place-based outcomes, the framework also focuses on individuals since both dimensions influence people's well-being and future opportunities.












In line with national well-being indicators, regional well-being indicators concentrate on informing about people's lives rather than on means (inputs) or ends (outputs). In this way, policies are directed to well-being features that can be improved by policies. Regional well-being indicators also serve as a tool to evaluate how well-being differs across regions and groups of people.

Regional well-being indicators are multi-dimensional and include both material dimensions and quality of life aspects. They also recognise the role of citizenship, institutions and governance in shaping policies and outcomes.

Although well-being dimensions are measured separately, the regional well-being framework aims to allow for comparisons and interactions across multiple dimensions to account for complementarities and trade-offs faced by policymakers. At the same time, the comparison of regional well-being indicators over time allows comparing dynamics of well-being over time, as well as the sustainability and the resilience of regional development.

Regional well-being in Sweden is measured along 12 well-being dimensions: income, jobs, housing, health, access to services, education, civic engagement, environment and safety – for which there are comparable statistics at the regional level – and the three additional dimensions of work-life balance, community (social connections) and life satisfaction. The OECD database has available comparable data at the sub-national level only for the first two. The figure below shows the details the indicator used for each dimension.

Figure 2.27. Indicators by well-being dimension, Upper Norrland

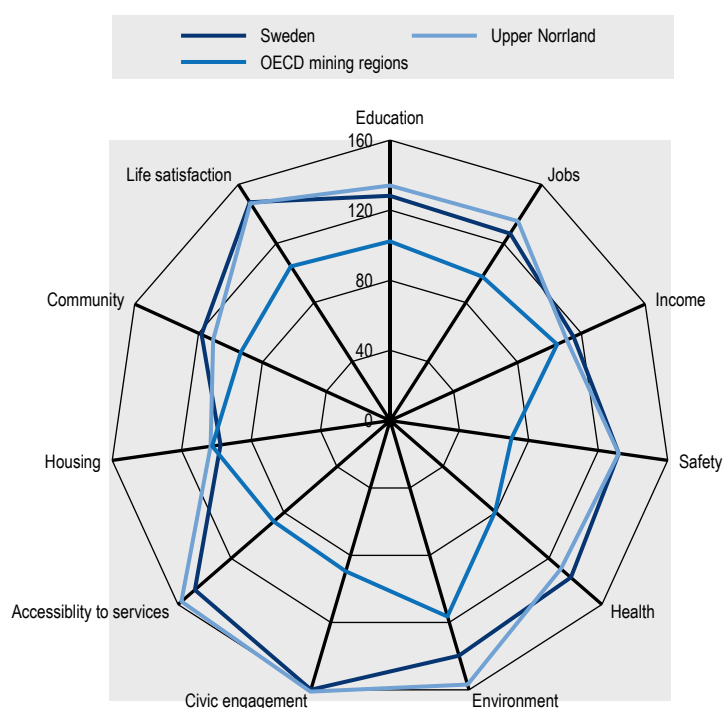
	Safety
	Homicide rate (per 100 000 people), 2016
	Community
	Perceived social network support (%), 2013
	Jobs
	Employment rate 15 to 64 year-olds (%), 2017
	Unemployment rate 15 to 64 year-olds (%), 2017
	Access to services
	Households with broadband access (%), 2017
	Life satisfaction
	Life satisfaction (scale from 0 to 10), 2013
	Environment
	Level of air pollution in PM 2.5 ($\mu\text{g}/\text{m}^3$), 2015
	Health
	Life expectancy at birth (years), 2016
	Age adjusted mortality rate (per 1 000 people), 2016
	Education
	Labour force with at least upper secondary education (%), 2017
	Civic engagement
	Voters in the last national election (%), 2017 or latest year
	Income
	Disposable income per capita (in USD PPP), 2016
	Housing
	Rooms per person, 2016

Source: OECD (n.d.^[29]), *OECD Regional Well-Being (database)*, www.oecdregionalwellbeing.org (accessed on 27 May 2019).

Upper Norrland has relative high well-being outcomes in comparison with the average of OECD TL2 regions and the OECD mining regions (Figure 2.28), depicting that Upper Norrland (TL2) performs above the average OECD TL2 regions in all of the 11 dimensions of well-being. The region ranks particularly high in civic engagement, environmental quality and access to services. The lowest well-being outcomes in comparison with OECD TL2 regions is on housing, where the region ranks just slightly above the average. Likewise, Upper Norrland performs above in all well-being dimensions than the average of OECD mining regions in all well-being dimensions, with civic engagement, access to services and safety registering having the best outcomes.

The picture is mixed when Upper Norrland's well-being is compared with the Swedish region average. Upper Norrland performs above Sweden's regional average in six well-being dimensions. Environmental quality, accessibility to services and education are the dimension with the highest relative ranking. In contrast, the region ranks below in four dimensions, where health, income and community support experience the lowest performance with respect to Sweden's regions average.

Figure 2.28. OECD Well-being, 2018



Note: Simple average of OECD TL2 regions = 100.

Source: OECD (n.d.^[29]), *OECD Regional Well-Being (database)*, www.oecdregionalwellbeing.org (accessed on 27 May 2019).

Overall, Upper Norrland stands out among all comparison groups in the following areas:

- **Environmental quality:** The geographic location of the region in a large geographical extension close to the Arctic offers a great variety of natural ecosystems with fresh water sources, mountains and forests. This is important for the tourism industry and the attraction of people who allocate a high value to outdoors activities.
- **High level of civic engagement:** Civic engagement matters for well-being as it allows for the expression of political voice and feedback to political leaders, essentially enhancing accountability and effectiveness of public policy (OECD, 2019^[30]). A higher voter turnout in a country like Sweden – already above OECD average – offers a fertile ground for the region to involve citizens in policy design and the implementation of strategic programmes (Chapter 3). Such civic engagement is also related to its industrial history. The region has the largest proportion of employees affiliated to a trade union or employer organisation (85% vs. 75% across Sweden).
- **Accessibility to services:** Despite its low-density and sparse settlement patterns, the region has made important efforts to ensure the delivery of quality public services. Part of its success comes from the large coverage of broadband in the region, which has enabled the delivery of education to remote municipalities. The share of households connected to broadband in Upper Norrland (99% in 2019) is above the average of European (98% on average in 2019) and OECD regions (70% on average in 2018) (Eurostat, 2020^[31]; OECD, 2018^[32]; n.d.^[29]). The information and communication technology (ICT) usage in Upper Norrland is also high. In 2019, the region recorded the highest share of people taking online courses (27%), far above the average in Swedish regions (15%). The effort on deploying high-quality public services has leveraged a relatively higher education outcome than the average of OECD and Swedish regions.

In contrast, Upper Norrland has a relatively lower performance in housing availability and health outcomes:

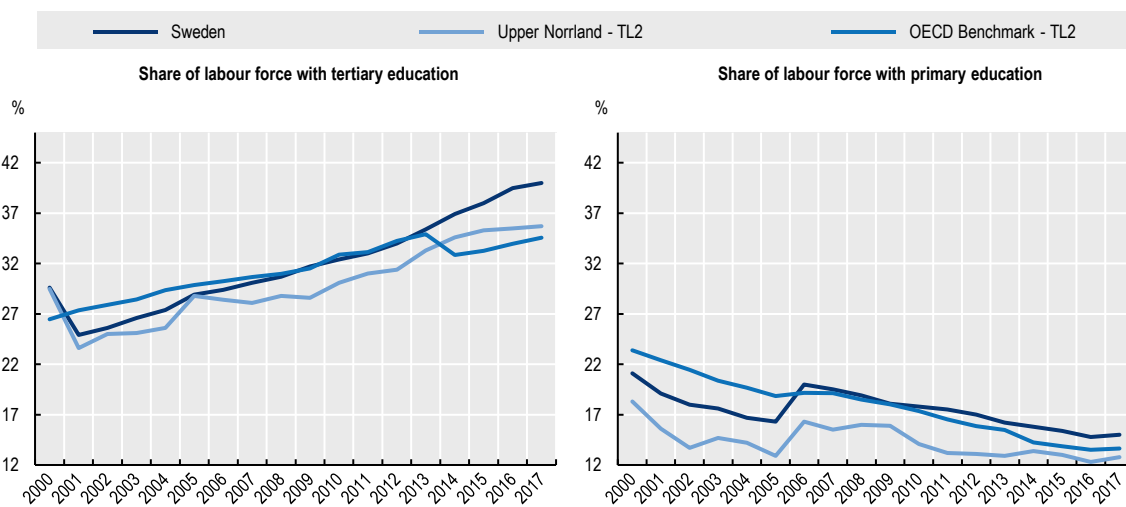
- In **housing availability**, the region seems to face challenges of land availability for construction. Norrbotten and Västerbotten rank among the three regions with a lower share of built-up land and associated land (Figure 2.2). Population decline has contributed to decreased housing demand pressures in certain areas of the region and lead to a slightly higher number of rooms available per person (1.8 in 2014) than the national average (1.7). However, in Norrbotten, many municipalities face challenges to develop new housing projects and increase the housing stock. Between 2000 and 2012, the dwelling stock in Norrbotten experienced a decrease (3%), in contrast with the increase of stock in Västerbotten (2.3%) and the Swedish regional average (3.6%). Such stagnation in dwellings is driven by years of restricted construction (Norrbottnens County Administrative Board, 2011^[33]), partly related to the high share of land classified as of national interest (Chapter 4).
- In **health**, indicators could improve within the national context. Upper Norrland, like Sweden, benefits from a lower rate of mortality (7.6 per 1 000 inhabitants) than the average of OECD regions (8.3). However, the region has the third-highest mortality rate among the eight TL2 Swedish regions (OECD, 2017^[23]). In 2016, Upper Norrland ranked as the second region with the highest obesity and overweight rates (54% of the population between 16 and 84 years old), above the national average (50%). Related health issues do not seem to lead to undersupply of healthcare, as the region has been a frontrunner in telemedicine and has a high share of healthcare personal. For example, Västerbotten has the highest ratio of licensed healthcare personnel (2 866 per 100 000 inhabitants) among all TL2 regions in Sweden, while Norrbotten ranks just slightly below the national average (2 146) (National Board of Health and Welfare, 2018^[34]). The sparsity of settlements and isolated population might explain part of the lower healthcare outcomes in Norrbotten (Norrbottnens County Administrative Board, 2011^[33]).

Upper Norrland's level of education stands out at the national level

The level of education in Upper Norrland is relatively high in Sweden and in the OECD context. In 2018, the majority of the population in Upper Norrland had at least upper secondary education and the share of the labour force with lower education is decreasing. Between 2000 and 2017, the share of the labour force with lower education dropped from 18.3% to 12.8%, reaching the levels of Stockholm. Correspondingly, the share of the labour force with tertiary educational attainment in Upper Norrland has risen in the past few years, from 30.1% in 2010 to 35.7% in 2017. This figure is above the level of TL2 OECD mining regions (34.5%) but below the national level (40.0%) (Figure 2.29)

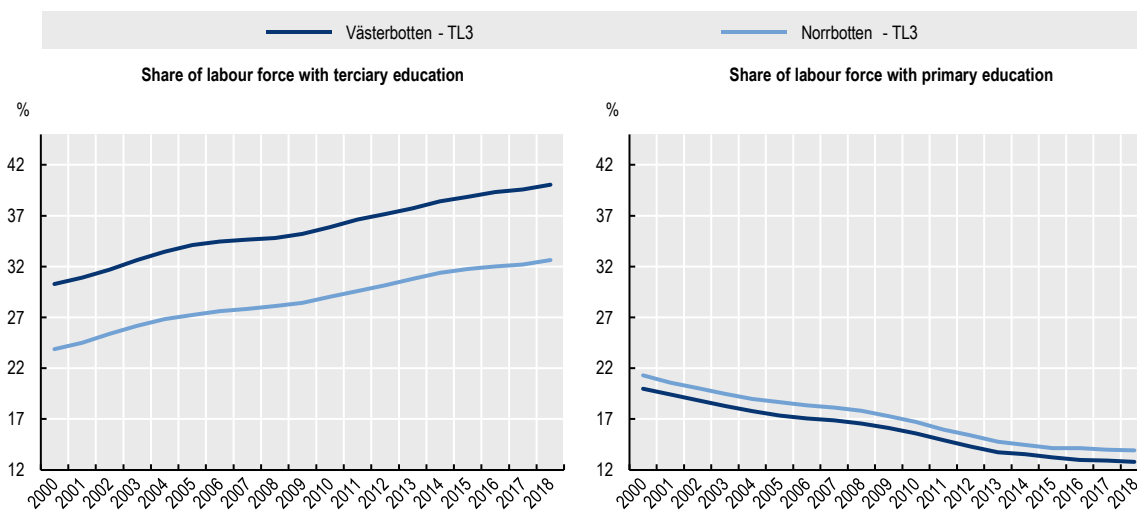
In Norrbotten, the share of the population with higher education has increased at a faster pace than in Västerbotten (Figure 2.30). Outcomes for youth in Norrbotten is an area of concern. There has been a divergence in the level of higher education with the national level, which reflects the labour market structure of the region and the move of higher-skilled young people to cities. On the other hand, a significant share of young adults aged 20-24 in Västerbotten have higher education, a share above the national average. The same occurs for the population aged 15-64. This is a key difference between Västerbotten and its northern neighbour. The high level of education is due to the large universities mainly in the big cities. However, there are big differences within the region in terms of the level of higher education, as smaller rural municipalities have very low rates (Figure 2.31).

Figure 2.29. Share of level of education over labour force, Sweden, Upper Norrland and OECD TL2 benchmark, 2001-17



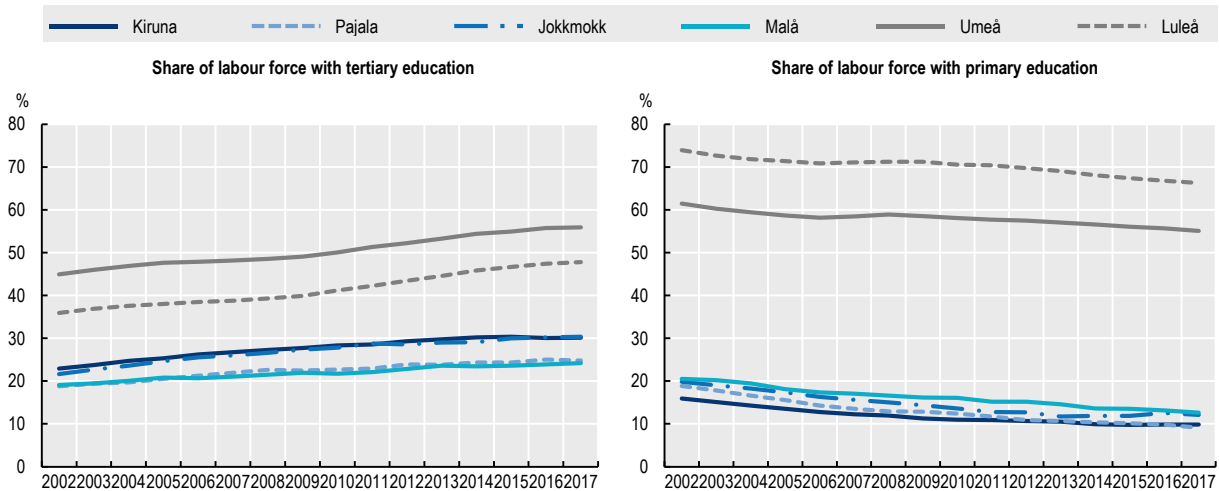
Source: OECD (n.d.[35]), "Regional Innovation", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

Figure 2.30. Share of the level of education over labour force, Västerbotten and Norrbotten, 2000-18



Source: OECD (n.d.[35]), "Regional Innovation", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

Figure 2.31. Share of the level of education over labour force, cities and mining municipalities, 2002-17



Note: The cities are Luleå and Umeå.

Source: OECD (n.d._[35]), "Regional Innovation", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

Upper Norrland is a highly innovative region

The levels of innovation are high compared to Upper Norrland. Two major universities enable a centre of high academic performance in the Upper Norrland region, Luleå University of Technology and Umeå University.

The European criterion for measuring innovation through a wide range of indicators, classifies Upper Norrland region as "Strong + Innovative" within the Regional Innovation Scoreboard (European Commission, 2020_[36]), positioning itself as an innovative environment. However, while patent applications and research and development (R&D) investments are reaching reasonable levels in 2018 (93.0 patent applications per million inhabitants), they remain below the national (247.4) and European (106.84) averages (European Commission, 2020_[36]). The spearhead of innovation in Sweden is located in the capital, Stockholm, ranking as "Leader +" with a high rate of patents applications per million of inhabitants (569.5) (Figure 2.32).

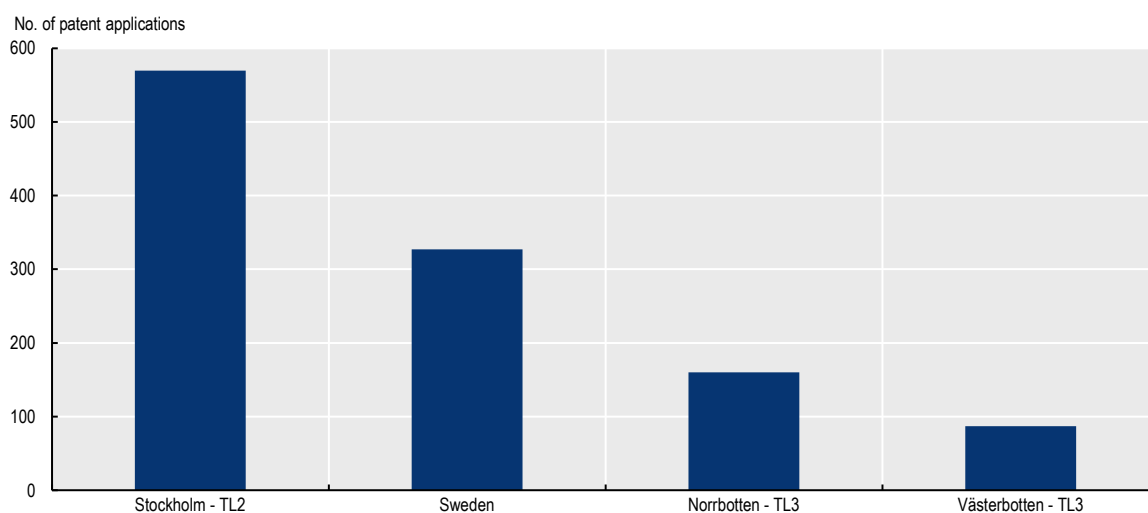
In terms of expenditure, the annual average business expenditure on R&D as a percentage of GDP in Upper Norrland was 2.4% over the period 2003-13, which is below the national average of 3.3% but above the EU average of 1.9% (European Commission, 2020_[36]).

Table 2.9. Regional Innovation Scoreboard (RIS), 2019

Stockholm	Leader +
East Central Sweden	Leader
Småland and the islands	Strong +
Southern Sweden	Leader
West Sweden	Leader +
North Middle Sweden	Strong -
Central Norrland	Moderate +
Upper Norrland	Strong +

Note: The RIS 2019 covers 238 regions across 23 EU countries.

Source: EC (2020^[37]), *RIS 2019 (database)*, <https://ec.europa.eu/docsroom/documents/36081> (accessed on 23 February).

Figure 2.32. Innovation in Sweden, Stockholm and Upper Norrland's TL3 regions, 2015

Source: OECD (n.d.^[21]), "Regional Labour", <http://dx.doi.org/10.1787/a8f15243-en> (accessed 27 January 2020).

In summary

The level of education in Upper Norrland outstands the rest of Sweden, the comparable benchmark and the OECD average. Education is precisely one of the best assets to face the challenges of the region. It helps to slow down migration by attracting young talent, mostly to cities home to the main universities. Robust public-private partnership structures have been made with industry, especially mining. This synergy, together with investment in R&D, has led Upper Norrland to be ranked as a high innovation region under the EU measures.

Annex 2.A. Selected OECD TL2 mining regions

Annex Table 2.A.1. Benchmark of OECD TL2 regions used for comparison with the TL2 region of Upper Norrland

Sub-region	Country	Code
Western Australia	Australia	AU5
Northern Territory	Australia	AU7
Newfoundland and Labrador	Canada	CA10
Saskatchewan	Canada	CA47
Alberta	Canada	CA48
Tarapacá	Chile	CL01
Antofagasta	Chile	CL02
Atacama	Chile	CL03
Coquimbo	Chile	CL04
Valparaíso	Chile	CL05
O'Higgins	Chile	CL06
Magallanes	Chile	CL12
Northwest	Czech Republic	CZ04
French Guiana	France	FRY3
South Aegean	Greece	EL42
Western Macedonia	Greece	EL53
Central Greece	Greece	EL64
Southern Transdanubia	Hungary	HU23
Gangwon Region	South Korea	KR06
Campeche	Mexico	ME04
Durango	Mexico	ME10
Sonora	Mexico	ME26
Tabasco	Mexico	ME27
Zacatecas	Mexico	ME32
Agder and Rogaland	Norway	NO04
Silesia	Poland	PL22
Northern Aegean	Turkey	TR33
Western Black Sea - West	Turkey	TR81
Northern Ireland	United Kingdom	UKN
Alaska	United States	US02
Kansas	United States	US20
Louisiana	United States	US22
Montana	United States	US30
New Mexico	United States	US35
North Dakota	United States	US38
Oklahoma	United States	US40
Texas	United States	US48
West Virginia	United States	US54
Wyoming	United States	US56

Note: Selection of regions based on the region's specialization in the mining sector as well as its location quotient and a desk research to select the suitability.

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Note

¹ The geographic concentration index offers a picture of the spatial distribution of population within a country, as it compares the share of the population and the land area of each region. Differences in geographic concentration between two countries may be partially due to differences in the average size of regions in each country.

3

Unlocking development opportunities with an enhanced mining ecosystem for Västerbotten and Norrbotten

This chapter provides policy recommendations to unlock the potential of Upper Norrland's mining ecosystem and support a sustainable future for local communities and business. It begins with an overview of Sweden's policy framework relevant to mining development. It then assesses the status of the mining ecosystem in Upper Norrland, identifying its strengths and weaknesses and its role for economic development and well-being. Finally, it examines the enabling factors of development in Upper Norrland, particularly the innovation ecosystem and the set of policies to unleash Upper Norrland's potential for sustainable development.

Assessment and recommendations

Assessment

- **Sweden needs to update the national mining strategy and better connect it with regional development strategies.** In doing so, Sweden can become a global leader in environmentally sustainable mining and play a key role in the global agenda of energy transition and in the European Union (EU) self-sufficiency strategy of raw materials supply. Such environmental and self-sufficiency agendas might gain more relevance in the aftermath of the coronavirus pandemic. To this end, Sweden's policy framework goes in the right direction by promoting innovation in the mining sector as a vehicle to boost economic growth and accelerate the transition to a zero-carbon economy. However, the national policy framework lacks clarity on the role of mining in the future development of Swedish regions, on the measures to mobilise the potential of the local mining ecosystems and on the benefit-sharing mechanisms for local communities.
- **Upper Norrland has currently a number of competitive advantages to become a global leader in environmentally sustainable mining.** They include a pool of frontier companies on mining technology that work in collaboration with universities and research centres, a low-cost and reliable green energy supply and a skilled labour force. To unleash the potential of its assets, Upper Norrland needs to connect municipalities with the innovation process of firms and universities, boost the innovation capacity of small- and medium-sized enterprises (SMEs) and entrepreneurship culture, and strengthen the implementation of a broad innovation strategy.
- **Upper Norrland needs to strengthen its business ecosystem to further diversify the economy and support a sustainable future for people and local businesses.** This process requires addressing the shrinking labour force and the outmigration of young people, improving co-ordination among municipalities to support business and employment, and enhancing training and education programmes to prepare the workforce for technological changes and further include women in value-added activities.
- **Upper Norrland can improve internal and external co-operation to consolidate its vision of development and support global environmental agendas.** For this, Västerbotten and Norrbotten need to improve the co-ordination of their development strategies and agree on a regional branding and a unified strategy for international co-operation to support the EU and Arctic environmental goals.

Recommendations

Strengthen and update Sweden's policy framework to become a lead country in sustainable mining. For this, the national government should:

- **Define a long-term vision to clarify the role of mining for regional development and support environmentally sustainable mining processes and technologies** within the National Strategy for Sustainable Regional Growth, the Swedish Innovation Strategy and Sweden's Mineral Strategy.
- **Update the National Mineral Strategy to incorporate the local strategies around mining.** This involves clarifying the role of regions and municipalities in the implementation of the strategy, mobilising the potential of small businesses in mining value chains and helping prepare regions to face global megatrends. The Canada Minerals and Metals Plan is a good example of a national plan that involves both national and regional governments in strategic actions.

- **Identify mechanisms to help mining regions capture greater value from ongoing and planned mining ventures.** It involves evaluating possible monetary and non-monetary benefit-sharing mechanism for mining communities and the framework to make the most out of them.
- **Strengthen the brand name of Sweden’s mining ecosystem to consolidate it internationally as a “sustainable mining” trademark.** This involves creating a single platform to consolidate and diffuse information on national and local mining ecosystems as well as provide advisory services and networking activities.

Enhance the innovation ecosystem in Upper Norrland to become a global leader in environmentally sustainable mining. For this, the regional councils of Västerbotten and Norrbotten should:

- Strengthen the integration of municipal governments in the innovation process of universities and mining firms by:
 - **Formalising co-operation between municipal governments and mining companies around innovation projects.** This can be done through formal meetings open to local businesses, research institutions and non-mining and mining municipalities.
 - **Promoting a formal collaboration among universities and regional and municipal development strategies to improve the innovation capacity of municipal governments.** The regional councils can learn from the partnership of Karlstad University and Region Värmland.
- Enhance entrepreneurship culture and the innovation capacity of mining suppliers and SMEs by:
 - **Strengthening the mechanisms to involve suppliers and SMEs in the innovation process of mining firms, especially concerning the transition to environmentally friendly practices.** This includes collaborating with the large mining firms in the value chain (from producers to manufacturing) to lift standards and innovation of mining suppliers and associated SMEs. The example of the BHP Billiton accelerator programme for suppliers in Chile can be a guiding practice.
 - **Boosting entrepreneurship culture and micro companies’ participation in innovation systems.** This involves including an entrepreneurial angle to the education and training programmes for the young and working-age population as well as providing insurance support to entrepreneurs, with targeted programmes for women. Furthermore, the ongoing collaboration with universities needs to be expanded to engage smaller firms through training (i.e. personal counselling) and access to universities’ research equipment and staff for business needs.
- Reinforce the implementation of smart specialisation strategies by:
 - **Developing an institutionalised platform for dialogue to monitor the implementation of the strategy and ensure the continuous engagement of all actors.** This platform should follow a cluster approach to channel funding for and implement strategies that connect mining innovation with other economic activities. This can follow the model of Georange by expanding it to other sectors and get inspiration from the Lapland approach.
 - **Leveraging European funds to align municipalities, universities and local businesses with the innovation strategy.** This should involve a co-ordinated approach to apply for these funds and to realise policy complementarities among different levels of governments of Upper Norrland.

Strengthen the local business environment to make the most of mining and diversify the economy. For this, both regional councils and municipal governments should:

- **Develop an institutional body to promote and oversee co-operation among municipalities.** This can be done through an institutional body within the regional council or the creation of an inter-municipal development agency, and should centralise economic information, co-ordinate municipal strategies and advise local businesses. Business Joensuu, in North Karelia, Finland, represents a guiding example for this type of structure.
- **Accelerate the attraction and integration of skilled migrants through better collaboration among municipalities and other regional actors.** This should involve enhancing job-matching services and exchange of information on migrants' skills among municipal governments as well as promoting further partnerships between migrant organisations, unions and businesses. Joint programmes with universities, an industrial PhD programme for example, can retain young people – especially women – and increase attraction of new residents.
- **Improve training and education programmes to prepare the workforce for technological changes and further include women in value-added activities.** This should be done through joint work with mining companies and universities to align vocational education and training (VET) programmes with future industry needs, provide targeted grants for training to workers in jobs at risk of automation (individual training accounts) and leverage technological changes to involve women in mining value-added activities.

Foment internal and external co-operation to consolidate Upper Norrland's vision of development and support global environmental agendas. For this, both regional councils should:

- **Define a common vision and brand for mining development in Västerbotten and Norrbotten.** This should capitalise in the existing platform Georange to develop a clear regional branding and strengthen international visibility by promoting the mining industry as a green and high technology industry.
- **Co-ordinate Västerbotten and Norrbotten regional development strategies to develop and internationalise technologies and practices for a carbon-free mining value chain.** This can be materialised through shared flagship projects that unlock synergies among ongoing local initiatives and actors, and attract funding from EU funds and external partners. Georange and the planned battery hub in Skellefteå can trigger such co-ordination.
- **Take a lead role in EU mining networks and Arctic co-operation to promote the benefits of the carbon-free mining value chain for global environmental agendas.** This involves enhancing its participation in international networks and increasing knowledge exchange with other Arctic regions, EU official and environmental actors to position sustainable mining processes as a relevant mechanism to support the EU and Arctic agenda for environmental transition and the EU agenda for self-sufficiency in raw materials.

Introduction

As depicted in Chapter 2, the TL2 region of Upper Norrland is an important economic engine for Sweden and a key player in the national and international mining production. In the short term, the region will face the effects of global slowdown associated with the COVID-19 pandemic, which has particularly affected mining regions (Chapter 2). In the medium and long terms, global megatrends, including demographic change, automation and a transition to a zero-carbon economy, will shape a new future for the mining industry and in turn for the development of the region. Further, the aftermath of this coronavirus crisis can bring new opportunities for Upper Norrland, linked to a renovated global interest to increase self-sufficiency on strategic sectors (i.e. raw materials) and accelerate the transition towards a zero-carbon economy.

To seize the benefits of this future, Upper Norrland needs to mobilise its mining ecosystem and unlock opportunities for a more diversified economy. These strengths include an innovative ecosystem of frontier mining and manufacturing companies that work in co-operation with universities, an enabling infrastructure with low-cost green energy and high-quality broadband coverage, and a skilled labour force.

Nevertheless, Upper Norrland faces a number of bottlenecks in the realisation of its potential and in attaining sustainable growth for people and local businesses. They include a shrinking labour force with outmigration of young women, a lack of co-ordination among municipalities to support local business and employment, challenges for SMEs development and complex framework for mining permits (Chapter 4).

The purpose of this chapter is to identify policy recommendations to realise the potential of Upper Norrland's mining ecosystem and support a sustainable future for local communities and businesses. The chapter confirms that Upper Norrland is well equipped to become an international leader in environmentally sustainable mining and, thus, along with Sweden, play a key role in global environmental agendas and the EU self-sufficiency strategy of raw materials supply. To this end, Sweden needs to update the national mineral strategy, while the two TL3 regions of Upper Norrland, Västerbotten and Norrbotten, need to strengthen the innovation ecosystem, improve the local business environment and enhance internal and external co-operation to consolidate a unified regional vision on mining development.

This chapter begins with an overview of Sweden's policy framework relevant to mining development. It then assesses the status of the mining ecosystem in Upper Norrland, identifying its strengths and weakness and its role for economic development and well-being. Finally, it examines the enabling factors for development in Upper Norrland, particularly the innovation ecosystem and set of policies to unleash Upper Norrland's potential for sustainable development.

The institutional environment for mining development in Sweden

Sweden is one of the EU's leading ore- and metal-producing countries. Sweden has 12 active ore mines (2020) and contributes to 90% of the iron ore, 39% of the lead, 37% of the zinc and 24% of the gold production in the EU. The business-mining environment in Sweden is relatively concentrated in terms of places and companies. The 12 metal mines in Sweden are located in three areas: Norrbotten, Västerbotten and Bergslagen mining district in the Svealand region. The two regions forming Upper Norrland (Norrbotten and Västerbotten) concentrate most of the mining operations in the country. Most of the mining operation and production in the country comes from two Swedish companies: LKAB and Boliden AB. The private company Boliden AB produces a wide range of metals, while the state-own company LKAB primarily produces iron ore. The country is also known by forefront companies in terms of mining equipment and a tight co-operation among mining companies, universities and research centres.

National institutions have an important role in developing the mining ecosystem. As the use of the land in Sweden is defined by national interest, the decision of exploration and exploitation is granted by national bodies:

- The Swedish Ministry of Enterprise and Innovation is in charge of nationally overseeing the mining sector and developing the national mineral strategy.
- The Geological Survey of Sweden (SGU) promotes the use of geological information and supports the development of a sustainable mining, rock and mineral industry. Within the SGU, the Mining Inspectorate is a separate decision-making body responsible for issuing permits for mineral exploration and extraction under the Minerals Act (Chapter 4).
- At the regional level, the Country Administrative Board (CAB) is the national government agency in charge of ensuring the alignment of the regional development with the goals set in the national policy. This body oversees the processes on mining permits, national interest areas and grants municipalities the rights to develop their land (Chapter 4).

Navigating a challenging national context for mining

Sweden had historically been seen as an attractive country to invest in with regards to mining exploration and operation. Good geological prospect, the sound quality of infrastructure (roads, broadband, harbours, energy and water supply) along with high-skill workers and stable institutions have made Sweden a good place to invest in mining projects.

However, in the last decade, the country has reduced its attractiveness as a place for mining investments. In the last years, Sweden's ranking in the Fraser Institute's mining investment attractiveness index has dropped from the top position achieved during 2013. This index is a ranking that represents the opinion of executives and exploration managers in the sector (290 responses in 2019).¹ In 2018, Sweden ranked as the 21st most attractive country for mining investment (among 86 jurisdictions), 15 positions below the rank in 2013 (6th out of 112 countries) or the one in 2012 (5th) (Stedman and Green, 2019_[1]). In the recent survey published in 2020 (with results for 2019), the country recovered some position ranking at 10th position. In this context, the number of valid exploration mining permits has declined in the last decade, from approximately 1 300 in 2008 to approximately 600 in 2018 (Chapter 4).

The perception of international investors and in turn the position in international rankings has been affected by recent institutional challenges and the improvement of mining potential in other countries. As Chapter 4 will depict, the regulatory framework for mining permits is complex and lacks predictability and transparency. The national government (represented by the CAB) is in charge of land use decisions, with significant discretion on land use issues and without being obliged to consider the regional development perspective (Chapter 4). This situation ultimately hampers the ability of regions to decide on the use of their land, creates uncertainties for investors on the result of the permitting process and led to a perception of a lack of co-ordination among CABs. This situation has very much affected the certainty with which regions plan their economic development and attract investors.

The relevance of Sweden's policy framework for mining development

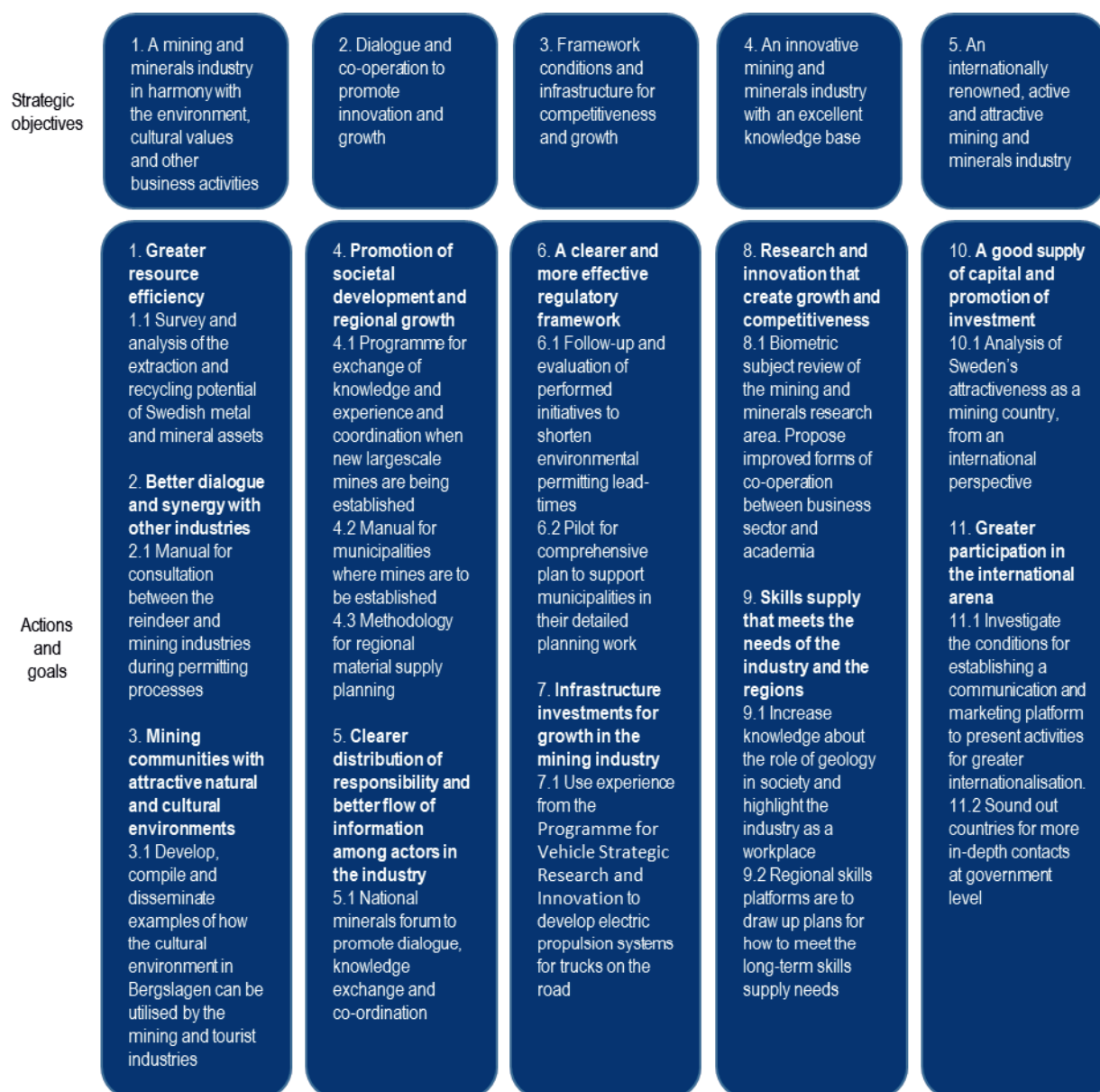
Sweden's national policy framework acknowledges the relevance of the mining sector to meet the country's development goals. In particular, the national policy strategies set innovation in the mining sector as a vehicle to accelerate the transition towards a zero-carbon economy. The national strategy for regional growth, the national minerals strategy and the national innovation strategy all provide guidelines for the sustainable development of the mining ecosystem in Sweden.

Sweden's Mineral Strategy

A national mining strategy is important because it can connect the different actors in the mining industry and provide clarity on the role and importance of mining at the local and national levels. It can help to educate stakeholders and the public on the opportunities and challenges involved in mining development

and outline ways to address them. Further, it is crucial to develop a common vision and help to align the objectives of a broad range of actors, define goals and provide guidance on how to best reach these goals.

Figure 3.1. Sweden's Mineral Strategy, 2013-20



Source: Swedish Ministry of Enterprise, Energy and Communications (2013_[2]), *Sweden's Minerals Strategy*, <https://www.government.se/contentassets/78bb6c6324bf43158d7c153ebf2a4611/swedens-minerals-strategy.-for-sustainable-use-of-swedens-mineral-resources-that-creates-growth-throughout-the-country-complete-version>.

Sweden's Mineral Strategy (2013-20) aims to increase the competitiveness of the Swedish mining and minerals industry to maintain its position as a leading supplier of raw materials in the EU. To do this, a priority of the strategy is to ensure sustainable use of mineral resources, in harmony with environmental, natural and cultural values. The strategy acknowledges the relevance of Sweden's mining industry in the context of the EU strategic goal to facilitate the sustainable supply of raw materials from their own deposits.

The strategy defines 5 strategic objectives that contain 11 action areas and goals to achieve the strategies vision.

1. A mining and minerals industry in harmony with the environment, cultural values and other business activities.
2. Dialogue and co-operation to promote innovation and growth.
3. Framework conditions and infrastructure for competitiveness and growth.
4. An innovative mining and minerals industry with an excellent knowledge base.
5. An internationally renowned, active and attractive mining and minerals industry.

The national minerals strategy identifies innovation as a cornerstone for the country's mineral development. Technological progress is set as a crucial tool to attaining sustainable mining activities and developing a strong mining value chain. At the core of such sustainability lays out the need of greater resource efficiency (the first strategic objective and action in Sweden's Mineral Strategy) to reduce mining environmental impacts and create new business opportunities (Swedish Ministry of Enterprise, Energy and Communications, 2013^[2]). The strategy stresses the need to increase the recycling rates of traditional (iron, aluminium and copper) and rare (lithium from batteries, gallium, germanium, indium from solar panels and neodymium from permanent magnets) minerals and metals.

Cross-sectoral and cross-agency work is a key action of this strategy. Most action points of the strategy are carried out by different national agencies, such as the Swedish Agency for Economic and Regional Growth and the National Board of Housing. For instance, collaborative work between the Swedish Transport Administration and the National Board of Housing is set to improve information on the extraction and recycling potential of various metals.

The National Strategy for Sustainable Regional Growth and Attractiveness

The National Strategy for Sustainable Regional Growth and Attractiveness (2015-20) is the guiding policy framework to stimulate sustainable regional growth throughout Sweden. It aims to invest in enabling factors to develop the potential of all areas of the country with stronger local and regional competitiveness (OECD, 2017^[3]). The strategy identifies four challenges related to demographic trends, globalisation, climate change and social cohesion (Box 3.1).

Box 3.1. National Strategy for Sustainable Regional Growth and Attractiveness (2015-20)

The National Strategy for Sustainable Regional Growth and Attractiveness 2015-20 is focused on a wide array of considerations ranging from innovation and employment to public services and transport. Relative to the prior strategy, it adopts a more cross-sectoral approach and relies on multi-level governance mechanisms for dialogue and learning along with a greater focus on results, monitoring and evaluation. The present strategy has increased the focus on sustainable and inclusive regions and has strengthened the dialogue with stakeholders at the regional level, within a formalised forum for dialogue between the national government and politicians as well as civil servants at the regional level.

The strategy outlines four societal challenges – demographic development; globalisation; climate, environment and energy; and social cohesion – all of which affect Sweden's regions and regional growth efforts. In order to contribute to the policy objectives and meet these societal challenges, while also taking advantage of the opportunities they present, four priorities for regional growth efforts have been identified:

1. Innovation and business development (including research and development [R&D], environmental technologies, access to capital and internationalisation).

2. Attractive environments and accessibility (including improving accessibility, access to services, spatial planning and tourism).
3. Provision of skills (including labour market matching, skills and lifelong learning, and reducing barriers to labour force participation).
4. International co-operation (regional co-operation within the EU and globally, and export and trade promotion).

Sweden's national regional policy also has a stronger focus on improving policy coherence between levels of government and the EU, and building capacity to implement it. The policy is based on more clearly setting out policy priorities, and roles and responsibilities. The national strategy specifies the areas that counties should focus on within each priority theme. Funding is provided for projects and activities which align with these regional plans.

Source: Ministry of Enterprise and Innovation (2015^[4]), *Sweden's National Strategy for Sustainable Regional Growth and Attractiveness 2015-20*.

The national strategy for regional growth outlines the relevance of the extractive and nature-based activities to increase resource efficiency and promote environmentally driven businesses in the country. A key development objective of Sweden is to enhance resource efficiency in terms of efficient use of energy, raw materials and ecosystem resources. Although there are no specific policies regarding the mining sector, this national goal provides the opportunity to develop sustainable and resource-efficient goods, services, technology solutions and production systems in mining activities. The so-called green investment fund within the National Regional Fund Program 2014-20 and the Energy Agency's conditional loan are important mechanisms to support businesses to transition and invest in environmentally sustainable technologies (Ministry of Enterprise and Innovation, 2015^[4]).

SMEs' development is key to implement a regional growth strategy with an environmentally sustainable approach. A cornerstone of the strategy is promoting the development of SMEs that want to transition towards more sustainable business. It supports policies to boost SMEs' innovation and focuses on their internationalisation as a tool to increase exports and foreign investment in Sweden. The strategy also highlights the importance of increasing collaboration between actors at different levels (regional and international) with different skills and resources around the sustainable supply of raw materials in order to address environmental challenges.

The national innovation strategy

The Swedish Innovation Strategy (2012-20) aims to meet global societal challenges (i.e. climate action and resource efficiency), increase competitiveness, create more jobs and deliver quality public services (Swedish Ministry of Enterprise, Energy and Communications, 2012^[5]). This strategy underpins the minerals strategy by setting technological progress as a cornerstone to increasing resources efficiency in the country. Beyond technological progress and new production methods, it recognises that innovation can take the form of new ways of using land, ecosystem services, raw materials from nature and biologically-/ecologically-based technologies.

The national innovation strategy acknowledges that regions' natural endowments can lead to unique innovation systems. Site-specific resources, including mineral resources, promote tacit knowledge and in particular innovation ecosystems. Characteristics around localised resources have been in fact identified in the national strategy as of large importance for innovation in Sweden (Swedish Ministry of Enterprise, Energy and Communications, 2012^[5]). To support regional innovation, the strategy stresses the relevance of increasing the added value of activities that are based on site-specific resources, including forests, minerals, water, cold and sparsity.

The strategy envisages a number of measures to support the innovation processes. It includes financing knowledge and innovation infrastructures (e.g. incubators), the formation of clusters or networks, and test and demonstration facilities. For example, the Swedish Energy Agency (Vinnova) and the Swedish research council Formas jointly finance 17 strategic innovation programmes (SIPs) following a cluster approach on specific themes. A number of these horizontal projects involve close work around the mining ecosystem:

- The Swedish mining and metal-producing industry programme (STRIM) aims to strengthen the sector's competitiveness and increase the sector's innovative capacity.
- The graphene programme has the goal of increasing the use of graphene in Swedish industry. Graphene is a material with the potential to resolve several global challenges (i.e. health, clean and efficient energy). A key action is to strengthen the knowledge transfer between different industries and to contribute to the Swedish graphene-based products reaching the market.
- The metallic material strategic innovation programme gathers Sweden's metals industries to meet growing demands for sustainable solutions. Industries involved include steel, aluminium, hard metals, cast steel and cast iron.
- The Process Industrial IT and Automation (PiiA) contributes to the development and use of automation and digitalisation within the industry. It identifies mining as a sector with high potential to develop automation.

The strategy also recognises the potential of increasing resource efficiency through better synergies among regional, national and international instruments and programmes. At the national level, it requires major efforts in strategic planning and a combined regional leadership in the growth agenda. The strategy also calls for the need to develop co-operation and co-ordination on innovation agendas between the EU and national, regional and local levels. This collaboration in and between innovation environments can take many different forms, including interlinked business networks and clusters in connection with research and education institutions.

Improving the national policy framework for the mining ecosystem

The need for a sustained supply of raw materials and metals with an environmentally sustainable mining process are common goals for Europe and Sweden's policy agendas. The EU has set high in its agenda the strategy to ensure a reliable and sustained supply of raw materials from EU countries (Box 3.2). The EU policy and strategy for raw materials involves strategic programmes to promote mining and research on rare metals and support resource efficiency and recycling.

Sweden has the potential to be a key player in the EU raw materials strategy and contribute to national and international goals on environmental sustainability. The Swedish mining sector is today at the forefront of sustainable practices. Swedish mining companies are developing cutting-edge projects to obtain minerals and produce materials through zero-carbon emission processes and recycling/reuse of waste mining and metals (see next section). Furthermore, the country is one of the most promising areas in Europe to discover traditional and new rare minerals (Luleå University of Technology, 2014^[6]).

Current national policy strategies of Sweden are moving in the right direction by supporting a close interaction among innovation, mining development and environmentally sustainable policies. This strategic vision has enabled the implementation of a number of initiatives to co-ordinate national and international actors. For example, the strategic innovation programme for the Swedish mining and metal-producing industry (STRIM), published in 2013, connects the vision of safe and productive mines with research and innovation needs (SIP STRIM, 2020^[7]). The programme has supported projects such as Smart Mine of the Future, which involves research and technical solutions to create a "zero-impact mine" that minimises residual products and the footprint of mining operations. Furthermore, in co-ordination with international actors, Sweden has led the European/Swedish SIMS project to develop solutions to test and demonstrate

new technology for the mining industry to create a Sustainable Intelligent Mining System. This project involves key players in the Swedish mining environment, from mining companies to equipment suppliers and universities.

Box 3.2. The EU policy and strategy for raw materials

Raw materials are crucial to Europe's economy. They form a strong industrial base, producing a broad range of goods and applications used in everyday life and modern technologies. Reliable and unhindered access to certain raw materials is a growing concern within the EU and across the globe. The European Commission's (EC) actions to ensure a sustainable supply of these materials can be divided into two interlinked parts: the Raw Materials Initiative and the European Innovation Partnership (EIP) on Raw Materials.

The Raw Materials Initiative

In 2008, the EC adopted the Raw Materials Initiative which set out a strategy for tackling the issue of access to raw materials in the EU. This strategy has three pillars which aim to ensure:

- Fair and sustainable supply of raw materials from global markets.
- Sustainable supply of raw materials within the EU.
- Resource efficiency and supply of "secondary raw materials" through recycling.

The strategy covers all raw materials used by European industry except materials from agricultural production and materials used as fuel. As a part of the initiative, the EC has identified a number of critical raw materials (CRMs) for the EU which are important for industry production, modern technology and the environment.

The EIP on Raw Materials

The EIP is the major EU initiative implementing the raw materials initiative stakeholder platform that brings together EU countries, companies, researchers and non-governmental organisations (NGOs) to promote innovation in the raw materials sector. The main objective of the partnership is to help raise industry's contribution to the EU's gross domestic product (GDP) by securing its access to raw materials. It will also play an important role in meeting the objectives of the EC's flagship initiatives innovation union and resource-efficient Europe. It will do this by ensuring the sustainable supply of raw materials to the European economy whilst also increasing benefits for society as a whole.

The EIP developed its strategic implementation plan with 95 actions to foster innovative solutions. These may be technological or non-technological. Specific actions include R&D, addressing policy framework conditions, disseminating best practices, building a knowledge base and fostering international co-operation.

Source: EC (2020^[8]), *Policy and Strategy for Raw Materials*, https://ec.europa.eu/growth/sectors/raw-materials/policy-strategy_en (accessed on 15 February 2020).

However, the national policy framework needs to further clarify the policy strategies to make Sweden an international leader in sustainable mining. Mining regions are key partners to move forward innovation and growth strategies. While there is a clear recognition of the relevance of resource-dependent regions in Sweden to attain a greater resource efficiency in the country, the national policy framework falls short in identifying mechanisms to connect mining activities with new economic opportunities at the regional and local levels. For example, Sweden's national strategy for regional growth lacks a vision on the role of

mining in the future development of Swedish regions. The national government should define a long-term vision to promote regional and local development through greater support for sustainable mining practices.

Such long-term vision will also require a promotion of cross-sectoral policies to support sustainable mining projects. It will require a co-ordinated strategy to unlock the innovative potential of local mining ecosystems and connect them with national and international markets. As we will see, regions such as Norrbotten and Västerbotten have a long history of mining development with a number of assets benefit (i.e. skilled workers, research centres and innovative mining companies) that can support the development of new solutions for a greener mining process and technology. A whole-of-government approach for developing sustainable mining should focus on strategies to mobilise regional assets.

The national strategies need to better co-ordinate their support to SMEs and suppliers involved in the mining value chain. As the next section will depict, small businesses in mining value chains are at risk of being locked into supplier relationships with large mining companies. The national strategy for regional growth and the innovation strategy provide a particular opportunity for SMEs and suppliers in the mining ecosystem. These strategies support investments in environmental technologies and the development of environmentally driven business. A close co-ordination of these strategies with an updated mineral strategy can set the ground for small businesses in Sweden to become an international model in sustainable mining.

Setting measures to increase local benefits from mining development

A revised mining strategy in Sweden could outline a framework and a set of measures to help improve how mining regions and municipalities benefit from mining activities, ensure shared value creation and compensate for the cost of negative externalities. Mining activities in Sweden as in OECD countries are spatially concentrated. While benefits of mining activities can be reaped by actors outside of the region (e.g. firms and national governments), negative externalities are often concentrated in the locations where mining takes place. This can create an uneven distribution of challenges resulting from these activities across territories.

Increased concerns for negative environmental effects of mining activities combined with the perception that automation can displace or reduce local employment opportunities have led many mining regions worldwide to increasingly emphasise the need for a more even sharing of the benefits of mining ventures (Söderholm and Svahn, 2015^[9]; World Bank, 2010^[10]). This is essential because support for mining and extractive activities will be undermined if local communities do not benefit from those activities through better economic opportunities and quality of life.

The updated strategy could help the national and regional governments to better share the benefits that result from mining activities with local communities. To this end, the strategy needs to first differentiate monetary and non-monetary benefits for mining communities and, second, make the most out of them. Monetary benefit-sharing mechanisms include investment funds, equity-sharing and tax-sharing mechanisms between regional and national governments. In contrast, non-monetary mechanisms include investments in education and medical facilities, local employment generation, local procurement and training of staff (Söderholm, 2014^[11]).

When it comes to monetary mechanisms, many countries specialised in mining and extractive activities have special tax regimes or monetary arrangements that collect the rents from extractives activities and revert them to the regions where they are extracted to different degrees (OECD, 2017^[12]). These royalty types of systems are guided by different principles depending on the country (Box 3.3).

- Some countries collect a proportion of extractive industry revenues at the national level and distribute them regionally through a development fund (Chile, Colombia).
- In federal countries, regions collect the revenues through differentiated royalty regimes (i.e. Australia, Canada).

In other countries, revenues from mining are mainly collected through national taxes and form part of the consolidated national revenue without a specific revenue transfer mechanism to mining regions (i.e. Finland) (Hojem, 2015^[13]). Sweden belongs to this last group of countries, where the tax distribution system does not include a special compensation for regions where the extraction of mining occurs. Sweden's royalty system introduced in 2005 only retains a small share of rents from mining activities, requiring companies to pay 0.015% of the average value of the minerals mined to the landowner (in many cases the same national government) and 0.005% to the national government (Hojem, 2015^[13]). In this regard, local governments of Swedish mining regions receive, just like any other local government in the country, fiscal revenues from the tax on resident's income, fees from child and elderly care and grants from the national government (through the equalisation and pharmaceutical grant).

Across the OECD, there is no "one-size-fits-all" mechanism to share the monetary benefits of mining activities with local communities. If not well designed, royalty systems that return revenues directly to mining municipalities may produce unintended consequences and even increase territorial inequalities (OECD, 2017^[12]). However, beyond the type of monetary sharing scheme, an efficient transfer system should take into account how the resources are utilised, how this aligns with regional development objectives and the way it interacts with other governance arrangement and fiscal equalisation schemes in the country. In Sweden, the equalisation system represents a relevant source of income for subnational governments. Despite this, a number of structural changes, including a shrinking and ageing population, are increasingly threatening the subnational government's financial capacity to maintain the same quality of services in certain places. Against this backdrop, a national committee in Sweden was established to analyse these challenges at the subnational level. This committee has recommended to Sweden's national government the revision and monitoring of its municipal equalisation system (Government's Official Investigations, 2020^[14]). This is in line with the OECD recommendation (2010^[15]) on evaluating mechanisms to increase municipal financial capacity by, for example, reinstating a property tax at the subnational level.

Box 3.3. Royalties schemes in countries and regions specialised in mining and extractive activities

Western Australia

The mining boom of the early 2000s led to increased tensions in Australia concerning the allocation of mining benefits, including mining benefits associated with operations on non-Aboriginal lands. In 2008, the Royalties for Regions programme aimed to address these concerns. The main goal was to return a larger share of the revenues generated by resource exports to the local communities where the mining occurs. The programme promotes long-term investments (e.g. in infrastructure) to develop the state's regional areas. All regional areas except the capital (Perth) qualify for the programme. The majority of the funding from Royalties for Regions is assigned to specific projects, rather than being assigned as general funding. In 2012, the state of Queensland initiated a very similar programme to invest in community infrastructure and long-term economic development and resilience. Some of the projects supported include flood mitigation capital works and improving the capacity, safety and connectivity of roads.

Canada

In Canada, extra revenues from mining ventures are mainly collected through mining taxes and royalties charged by the provinces. The federal government only collects revenue from mining activity through regular income taxation. The mining tax revenues in Canada therefore tend to accrue to the provincial

governments. However, in addition to the fiscal revenues from mining, community development agreements have also been frequently used since the 1980s.

Chile

Apart from general taxes, the Chilean state collects Special Mining Income Tax. In 2005, the tax system was amended to establish a special tax over the operational revenue of mining activities. The special tax has a progressive rate depending on the annual sales of mining produced by the taxpayer and its Chilean related parties. The revenues from this tax are distributed between the municipalities of the region and the National Fund for Regional Development (FNDR). The FNDR seeks to compensate territorially for harmonious and equitable development throughout the country. It finances various projects aimed at fostering regional development.

Colombia

In 2011 Colombia reformed its royalty system by shifting from an arrangement in which royalties benefitted mining and resource-rich departments to one in which the allocation of royalties is spread out more evenly across the country through the General System of Royalties (SGR). The SGR represents a large share of public investment in Colombia by providing sub-national governments with direct funds for projects. The SGR created a network of collegiate bodies that involve representatives from different levels of government and educational institutions to assess and approve the projects presented by sub-national governments that are financed with royalty recourses. Given the lack of capacity in rural municipalities to design and apply for projects, the SGR resulted in fragmentation of investments with limited impact on long-term regional development. Strengthening regional institutional capacity is now one of the main priorities of the system.

Source: Söderholm, P. and N. Svahn (2015^[9]), "Mining, regional development and benefit-sharing in developed countries", <http://dx.doi.org/10.1016/j.resourpol.2015.03.003>; OECD (2017^[12]), "Mining regions and their cities", https://www.oecd.org/cfe/regional-policy/Mining%20discussion%20paper%20FINAL_CM.pdf; Söderholm, P. (2014^[11]), "Mining, regional development and benefit-sharing", Luleå University of Technology.

In terms of non-monetary benefits, the strategy should identify different mechanisms to help mining regions capture greater value from ongoing and planned mining ventures. These mechanisms should consider different dimensions of well-being (income, jobs, education and training, housing, amongst others) to ensure benefits match local needs. This can improve the overall social acceptance of mining in the regions. In Upper Norrland, the identification of local needs and the introduction of new policies in this regard should happen in partnership with the local stakeholders and the Sami Parliament (see also Chapter 4).

Mining companies increasingly recognise that successful long-term business performance includes respecting societal needs and contributing to local economic development. Some of their actions have included local procurement of goods and services, creation of employment and development of local skills (Cosbey, 2016^[16]). Swedish mining companies have historically adopted practices to compensate local communities in terms of public goods and enhancing well-being (see next section). However, these are voluntary practices that might stand or not in future arrangements or with new companies, which makes it relevant for the new strategy to clarify a sharing mechanism framework. Further, as national and local governments often play an important brokering role in this regard, policy responses can be quite effective in upgrading or increasing local inputs into the production processes in the extractive industries. These include:

- Reducing information and capacity gaps that diminish local firms' chances of responding to extractive firms' tender.

- Offering technical or business assistance to suppliers and SMEs and supporting them in the obtention of necessary certifications to respond to the needs of extractive firms.
- Ensuring timely payment facilities for SMEs with limited cash flow.

The rest of this chapter will describe possible actions to improve local development through mining activities, including further measures to create an open and supportive business environment for both extractive industries and their suppliers, as well as foster the transfer of technology.

Consolidating the “sustainable mining” trademark for Sweden’s mining sector

Becoming a powerhouse in sustainable mining requires clear communication with local and international actors. Sweden has two main platforms that gather and diffuse information about the mining industry. The Geological Survey of Sweden (SGU) currently features all the information related to ore deposits, active mines and exploration and exploitation permits, among others. Mining for Generations – Mining by Sweden is a different platform developed from a government and industry initiative and run by Business Sweden. This communication platform promotes Swedish mining industry internationally and aims to increase collaboration between mining companies, technology companies and academia. This site gathers information from all Swedish companies, industry association and other relevant actors for the mining industry

While both platforms are useful resources of information and promote the mining industry, Sweden can improve the way of marketing its mining ecosystem and attract foreign companies into the mining value chain. These communication platforms need to promote the future vision for mining in the country and present assets more clearly at the national and regional levels. Currently, both platforms present the information from a national level perspective with little reference to particularities in mining regions and the different mining clusters around the country.

A single platform to display the whole information around mining would help in the endeavour of making Sweden a key player in minerals and metals. It can also help to reach international partners with a unified voice that promotes the benefits of carbon-free mining value chains for global environmental goals. A platform that highlights the assets at the national and local levels and promotes regional clusters can contribute to sectoral and regional collaboration. The Mining Finland programme can inspire the Swedish government to consolidate all the information in a unique platform with a clear link to the mining business ecosystem (Box 3.4). This programme goes beyond information sharing by providing stakeholders of the mining ecosystem with a number of services, including training and networking activities.

Box 3.4. The Mining Finland programme

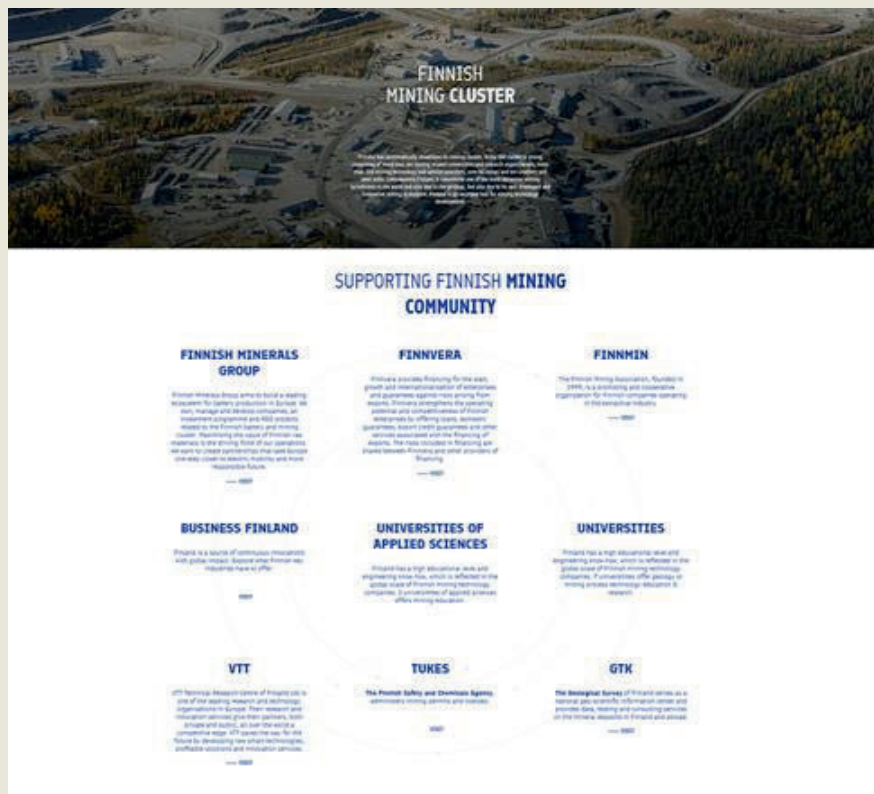
The Mining Finland programme is a platform that condenses in a single site all the information related to the mining activity in the country. It includes information on current active mines, the exploration mining projects and the prospective of resources. The platform also shows the current composition of the Finnish mining cluster, promoting the mining and services companies established in the country.

Stakeholders wanting to be members of the programme must pay a membership registration fee. The membership gives companies and organisations access to all of the services offered by the programme, including:

- Company visibility on programme websites, brochures and publications.
- Direct contacts with international mining industry actors, Finnish embassies and Business Finland export centres.

- Free participation in the programme's international trade shows, congresses and roadshows excluding own travel and accommodation costs.
- Free participation in the programme's networking and match-making events, excluding own travel and accommodation costs.
- Generic training events.
- Access to GTK's and Business Finland's expert services and network.

Figure 3.2. Online interface of Finish Mining Cluster



Source: MininginFinland (2020^[17]), *Mining Finland Programme*, www.miningfinland.com (accessed on 15 January 2020).

The mining ecosystem of Upper Norrland

Mining, wood and metal processing are major sectors in Upper Norrland. These three sectors are among the main exports of Sweden. Upper Norrland also plays an important role in the national energy sector, providing almost half of the country's energy production coming from hydroelectricity and with a growing wind and bioenergy sector. Upper Norrland is the main mining region of the country, concentrating most of the national production on iron ore, copper and gold. Norrbotten hosts the largest underground iron ore mine in the world (in Kiruna Municipality), Europe's largest copper mine and Sweden's largest gold mine (Aitik).

The lead mining region in Sweden, with historic mines owned by a few Swedish companies

Västerbotten and Norrbotten have a long history of mining and the sector plays a key role in the economic growth of the region. Since the 17th century, the state facilitated the mining development, with Dutch and Swedish entrepreneurs opening the first iron mines (Keskitalo, 2019^[18]). Since the beginning, local communities were very much involved in this activity, to the point that companies contracted Sami and local farmers to transport ore and charcoal with reindeer- or horse-drawn sledges (Keskitalo, 2019^[18]). By 2018, the mining and energy sector provided most of the income (25% of total gross value added [GVA]) and the employment of the region (Chapter 2). Given the high contribution from the mining sector to the GDP per capita, Norrbotten ranks in top three Swedish counties in terms of GDP per capita.

Many of the existing mines in the region, as in the rest of the country, are relatively old (Table 3.1). Norrbotten hosts two of the oldest mines in Sweden, that started around 1890 when the railroad reached Gällivare and Kiruna. During the metal price boom of the early 2000s, companies made important investments to boost production and enhance prospecting (Keskitalo, 2019^[18]). This led to the reopening of closed mines, mainly in Norrbotten (Kiruna) and the opening of some new mines in Norrbotten (Kaunisvaara) and Västerbotten (Kankbergsgruvan). Upper Norrland was the only region of Sweden that has opened completely new mines in the current century. This dynamic depicts the country relevance of the region but also the slow evolution of mining exploration in the country during the last decade.

By 2019, the region is home to almost all operating mines in Sweden. Out of the 12 mines in production in the country, 9 are located in Upper Norrland, of which 5 in Norrbotten and 4 in Västerbotten (Figure 3.3). In Norrbotten, 4 out of the 5 mines produce iron, accounting for 90% of Europe's iron ore. Norrbotten mines are located in the northern municipalities of the region, particularly in Gällivare, Kiruna and Pajala. In the case of Västerbotten, most of the mines produce lead, gold, copper, zinc and silver and are concentrated in the municipalities of Lycksele and Skellefteå.

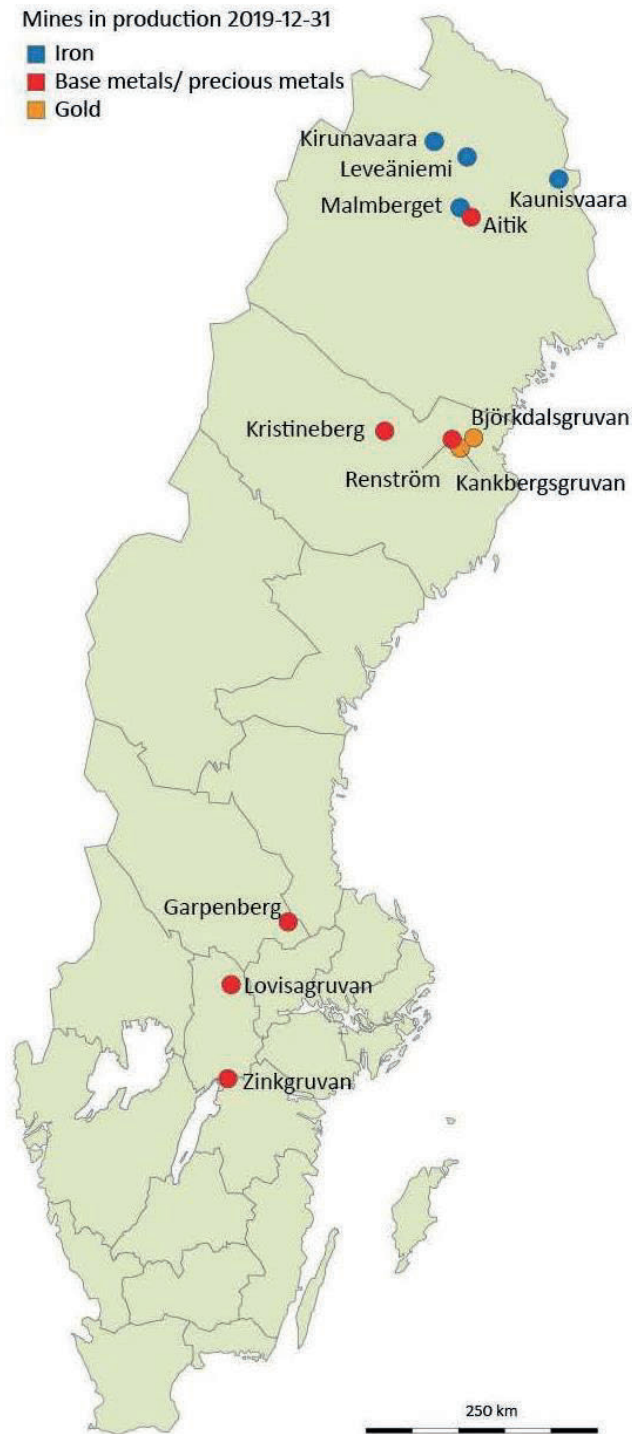
The ecosystem of mining companies in the region consists mainly of Swedish companies (Table 3.1). The state company LKAB and the private company Boliden Mineral AB operate in total seven out of the nine mines in Upper Norrland. LKAB is the main mining company in Norrbotten, while Boliden is the main operator in Västerbotten. Two other Swedish companies, Björkdalsgruvan AB and Kaunis Iron, own one mine in Västerbotten and another in Norrbotten respectively. In the past, companies from Australia and Canada operated mines in the region, but today any foreign company operates a mine. This picture is, however, different in mining exploration, where a number of foreign companies are in the exploration stage or waiting for the exploitation permit to be granted.

Table 3.1. Mines in Sweden by owner and opening date in 2019

Mine	Region TL3	Municipality	Owner	Mineral	Established
Malmberget	Norrbotten	Gällivare	LKAB	Iron	1820s
Kiirunavaara	Norrbotten	Kiruna	LKAB	Iron	1860s
Aitik	Norrbotten	Gällivare	Boliden Mineral AB	Gold, copper, silver	1968
Leveäniemi	Norrbotten	Kiruna	LKAB	Iron	1964-1983, restart 2015
Kaunisvaara	Norrbotten	Pajala	Kaunis Iron AB	Iron	2012-14, restart 2018
Björkdalsgruvan	Västerbotten	Skellefteå	Björkdalsgruvan AB	Gold, copper, silver	1989
Kristineberg	Västerbotten	Lycksele	Boliden Mineral AB	Lead, gold, copper, silver, zinc	1940
Renström	Västerbotten	Skellefteå	Boliden Mineral AB	Lead, gold, copper, silver, zinc	1948
Kankberg	Västerbotten	Skellefteå	Boliden Mineral AB	Lead, gold, copper, silver, zinc	2012

Source: Mining Inspectorate of Sweden (2020^[19]), *Mines in Sweden*, <https://www.sgu.se/en/mining-inspectorate/mines/mines-in-sweden/> (accessed on 15 May 2020).

Figure 3.3. Open mines in Sweden 2019



Source: Mining Inspectorate of Sweden (2020_[19]), *Mines in Sweden*, <https://www.sgu.se/en/mining-inspectorate/mines/mines-in-sweden/> (accessed on 15 May 2020).

LKAB and Boliden have historically established a close collaboration with their communities. In Gällivare and Kiruna, LKAB has contributed to the development of the railway – in particular to the current line connecting Northern Sweden with the Norwegian city Narvik – and the construction of a hospital, fire station, a sewerage system, roads and a church. This long relationship with local communities has contributed to creating a positive social acceptance with the operations of the two major Swedish companies. However, as Chapter 4 will explain, such acceptance is different when it comes to new mining projects led by foreign companies.

A mining value chain with a local focus

The large mining companies in Upper Norrland have developed large mining infrastructure and an extensive network of local suppliers. Mining operations in the region tend to fulfil an important share of the demand with the offer of local business. Ejdemo and Söderholm (2011^[20]) have found that, for every 100 jobs created in mining, about 100 to 150 jobs are created elsewhere in the local economy (also referred as an employment multiplier of 2 to 2.5).² However, the mining ecosystem varies between Västerbotten and Norrbotten in terms of the local actors involved in mining value chains.

Västerbotten has developed a more diversified economy with a lower share of workers in mining industry and smaller deposits and a number of new businesses in both core and related mining activities (MineFacts, 2019^[21]). Västerbotten has benefitted from a dynamic entrepreneurship environment with small companies working in sectors outside of mining, which is evident from its higher share in the service sector (Chapter 2). In the region, Boliden is home to Sweden's only smelter which produce base metals (located in Skellefteå) and a concentrator and leaching plant for gold and tellurium production.

Norrbotten, in contrast, is more dependent on mining activities with a higher share of its population working in the mining industry. The predominance of iron mines in Norrbotten has created a mining environment characterised by relatively larger production volumes than in the rest of Sweden but at the cost of higher vulnerability to fluctuations in the international commodity price of iron (Chapter 2). In Norrbotten, this large scale of mining has led to the creation of local networks of local suppliers. In Kiruna, the manufacturing and extraction industry is the largest employer, followed by the health and social care industry with about half the number of employment share. Furthermore, mining operations in Norrbotten find many of the suppliers in the same municipality or region. For example, in the mining operation in Pajala Municipality, 23% of the suppliers are from the same municipality and 45% from the same region of Norrbotten. This dynamic also creates an environment where entrepreneurial culture is highly driven by mining operations. In Kiruna, out of the 100 companies created per year, around one-third are related to mining activity.

Regional institutions are also involved in mining development. The regional council defines the regional development strategy, including strategies to improve the business environment and the development of local clusters. This body is governed by a regional assembly (*regionfullmäktige*), elected every four years. The regional councils of Norrbotten and Västerbotten have developed their own regional strategy. When it comes to mining development, the regional council has to co-ordinate strategic policies with the CAB and take decisions based on national guidelines. Trade unions are important players in the mining ecosystem, as Sweden has one of the highest levels of memberships in trade unions in the world. IF Metall is a large union that operates with a large number of metal industries in Sweden, with a division covering the area of the northern parts of Norrbotten.

Assets of and challenges for the Upper Norrland mining ecosystem

Assets

The mining environment in Upper Norrland benefits from a number of assets, which makes it a strategic place for mining development. It includes innovative large mining companies, a strong pool of research centres and universities, a skilled and experienced workforce and cheap and reliable energy supply.

The companies working in the mining sector of Upper Norrland are at the frontier of mining technology. Given the technical difficulties for mining operations posed by the Arctic climate, the companies have developed cutting-edge technologies and equipment to operate in the region. This technology is now world-renowned and recognised for its quality. ABB, Atlas Copco HW4it (Epiroc), Sandvik, Scania and Volvo are some of the many Swedish companies providing technology solutions to the mining sector.

The mining companies operating in Upper Norrland are at the forefront of technological development in the CO₂-free mining process. Regarding the zero-carbon mining process, large mining companies in the region (Boliden and LKAB) have conducted in-house projects to attain environmentally sustainable mining operations. Boliden conducts a number of projects on electrification, automation and 5G network deployment within mines. In the case of LKAB, the state-owned company is currently undertaking a number of key projects that aim to make the entire value chain from mine to steel carbon-free in the next 20 years:

1. The **HYBRIT project** aims to produce fossil-free steel, by developing a CO₂-free pelletising process and fossil-free iron making through the use of hydrogen gas. This partnership between LKAB, SSAB and Vattenfall will create a competitive advantage for mining production in the region by supporting the carbon-free production of steel.
2. The **REEMap project** identifies opportunities to extract critical and rare raw materials from mining waste.
3. The **Sustainable Underground Mining (SUM) project**. In joint collaboration with ABB, Combitech, Epiroc and the Volvo Group, the project aims to set a new world standard for sustainable mining at great depths by developing new control systems, mining equipment and complex and efficient management systems (Sustainable Underground Mining, 2020^[22]). This involves a physical testbed in LKAB underground mines and also a virtual mine. The development of an autonomous mine has the scope to increase labour productivity and save costs by using, for instance, autonomous vehicles and a smaller ventilation system.

Swedish companies have also become international leaders in circular economy strategies for the mining process. A number of projects have invested in recycling waste material to extract traditional and rare metals. LKAB is conducting a research project to extract rare earth metals from apatite, a material that today goes to waste in the Kiruna and Malmberget iron ore mines. The recycling progress in iron ore is conducted in joint work with steelmaker SSAB, which has major operations in Luleå. In Västerbotten, Boliden's smelter in Skellefteå has become a world leader in the recycling of electronic waste (MIREU, 2020^[23]). This plant processes copper and lead concentrates from Boliden's own mines and external suppliers and produces copper, zinc, lead and precious metals. It has a capacity of waste recycling of 120 000 tonnes of electronic scrap per year. From that waste, the company extracts copper, gold and silver.

A pool of academic and research centres supports the development of eco-friendly products, processes and technology for mining and metallurgy. Umeå University, Luleå University of Technology and Tromsø University are recognised for their specialised academic track on design, mining and environmental sciences. Luleå University is the main high education institution in Norrbotten and stands out for having the highest percentage of externally-funded research of any university in Sweden (61%) (Academic Ranking of World Universities, 2019^[24]). It has become the research and training centre for the mining industry and process metallurgy with specialised courses for young people and professionals in the mining sector. Umeå University, in Västerbotten, has a large number of degrees taught in English, including more than 30 two-year master's programmes in science and technology, social sciences, business, health and medicine and the arts.

The mining industry has historically collaborated with universities to conduct research on mining and metallurgy. In close collaboration with Luleå University, Boliden, LKAB and Zinkgruvan, through the Bergforsk foundation, created the Rock Tech Centre AB (RTC), which gathers expertise from academia, independent consultants and smaller companies to improve the mining process by working on demand for specific projects from the industry (the centre is currently undergoing a voluntary liquidation process). Luleå University also hosts the Centre for Advanced Mining and Metallurgy (CAMM), a strategic national research area assigned to the university with the goal to study the sustainable use of natural resources. Norrbotten also hosts the national innovation programme SIP STRIM. Another relevant outcome of research and private sector co-ordination is the research institute Swerim (formerly MEFOS), based in Luleå and Stockholm, which focuses on metallurgy. Boliden and LKAB are both industry partners in this institute, together with other major actors in Sweden including Sandvik, Scania, SSAB and Volvo.

Furthermore, Skellefteå Science City is promoting innovation in established companies with the ambition of creating a world-class cluster for battery manufacturing and recycling. The skilled and experienced workforce in mining activities is also a strength in the region (Chapter 2). There is good access to higher education with universities, colleges, vocational colleges and active research and development activities in a number of localities.

The region also benefits from a platform – Georange – to promote knowledge exchange and co-ordinated work around different actors to develop the mining and minerals industry. This is a non-profit organisation that gathers 54 members – including municipalities, organisations, universities and private companies – with the aim to create conditions for the development of new and existing companies in the mining industry. Main goals of the organisation involve: i) securing a frequent meeting place for mining, mineral and associated industries in the north of Sweden; ii) forming a working network of companies, academia and the public sector; and iii) creating constructive and efficient methodologies to be used in the event of overlapping activities within the same land areas. It participates in applications for national and EU funds and develops conferences and trade fairs on mining every two years.

Sustainable and reliable green energy powers most of the industries in the region. Upper Norrland provides 21% of the energy in Sweden, mainly from hydropower, and hosts wind power with the greatest generation capacity in the country (Arjeplog, Norrbotten). Wind and solar power are increasing rapidly in the region thanks to extended hours of direct light in summer to feed the solar panels and strong winds to power the wind farms. By 2020, Sweden plans the construction of the largest wind farm in Europe (Markbygden Wind Farm) – providing almost 30% of current national capacity (EC, 2017^[25]). The low-cost and secure energy provision in the region has contributed to attracting global companies and electricity-intensive investments, such as Facebook that built, in 2013, its first European data centre in Luleå.

The region also benefits from an important geological potential. The region is part of the Fennoscandian Shield, an area of old crystalline and metamorphic rocks, whose mineral deposits are considered high quality internationally (Warell and Häggquist, 2016^[26]). Iron, zinc, silver and rare earth metal deposits represent an opportunity for Sweden to become a key player in the supply of minerals worldwide. According to the Fennoscandian Shield database, jointly produced by the geological surveys in Finland, Norway, Russia and Sweden, 90% of the country's non-exploited sites are located in the region of Upper Norrland (GTK, 2020^[27]). The largest non-exploited areas in Northern Sweden have been identified in Arvidsjaur, Jokkmokk and Kiruna Municipalities in Norrbotten and Skellefteå mining district in Västerbotten.

Furthermore, Sweden is also known as a potential bedrock for rare metals. Some authors refer to Sweden as the "home of the rare earth elements", given that both the first light and first heavy rare earth elements (REE) were discovered there during the late 18th and early 19th centuries (EURARE, 2020^[28]). Great potential for these metals comes from the same iron deposits located in Upper Norrland, which has anomalously high concentrations of REE (EURARE, 2020^[28]). Hence, Upper Norrland has the opportunity to become a key player in the European strategy for raw materials by enhancing the mineral recycling process and the extraction of rare materials from known deposits.

The geographical location, close the Arctic circle, makes Upper Norrland a strategic region for national and international interests. The region is the northernmost in Sweden, featuring some of the richest ecosystems in the country – Sweden’s highest mountain and its deepest lake (Hornavan). The Arctic’s fragile environment and its relevance for domestic and foreign policy have led Sweden to develop a particular Arctic policy strategy (Box 3.5). The Arctic environment offers the ability to create sustainable growth and development in areas with a cold climate, long distances, sparse population and a sensitive environment.

Box 3.5. Sweden’s Arctic strategy

In 2011, Sweden adopted a strategy for the Arctic region based on the process of far-reaching change in the Arctic. This strategy is currently being revised. The strategy has five main axes:

Seeking influence via co-operation

Given its small population size of only 10 million, principled stance on neutrality and meagre geopolitical weight on the global stage, Sweden’s foreign policy is firmly based on the principle of multilateralism and institutional co-operation with like-minded nations. With regard to its Arctic policy, the policy attaches special importance to its co-operation with Finland, followed by its co-operation with the other Scandinavian and Baltic states within the Nordic Co-operation (NC) – comprising the intergovernmental Nordic Council of Ministers and the inter-parliamentary co-operation within the Nordic Council – and the (NORDEFECO).

Climate change

Sweden has put in place a comprehensive approach towards climate change in general and in the Arctic in particular. Stockholm’s approach has economic, security, scientific and soft power aspects to it. As such, it is concerned with both the ways in which atmospheric changes could affect the region’s ecosystem and the locals’ lives and how to mitigate negative effects and benefit from changing conditions.

Security and defence

Sweden’s strategic priority lies in the Baltic, evident in the fact that the Arctic is rarely mentioned in relevant foreign and defence or security policy statements. The Arctic, it appears, is more seen as a collective Northern or Scandinavian policy area that is best dealt with in co-operation with the EU and NORDEFECO. It considers Finland’s security as its own to the extent that any threat to Finnish territorial integrity is deemed as a threat to Sweden’s territory.

Economics and trade

Some, while not all, Arctic communities have similar climatic and, albeit to a lesser extent, cultural and societal characteristics, and thus local businesses can establish a presence in other Arctic regions and states easier and more cost-effectively. The Swedish government is directly and indirectly (by encouraging the private sector) investing heavily in the start-up scene of its own Arctic region, setting up incubators like ABI, a start-up incubator that only works with local start-ups. These efforts are further complimented by Finnish and Norwegian policies, which pursue the same priorities when it comes to the economic development of their Arctic regions.

Indigenous peoples – The Sami

There are around 70 000 Sami and around 20 000 of them live in Sweden. In the Arctic region, Sweden strives to ensure that Indigenous peoples have greater scope for preserving and developing their identity, culture and traditional industries and facilitate their traditional knowledge gathering and

transfer. Active participation in decisions affecting them is required if Indigenous peoples are to be able to meet future challenges. Sweden highlights the human dimension and the gender perspective in the Arctic Council.

Source: The Arctic Institute (2019^[29]), "Sweden's Arctic strategy: An overview", <https://www.thearcticinstitute.org/sweden-arctic-strategy-overview/> (accessed on 27 January 2020); Arctic Council (2015^[30]), *Sweden and the Arctic Region*, <https://arctic-council.org/index.php/en/about-us/member-states/sweden> (accessed on 27 January 2020).

Risks and bottlenecks.

An ageing and declining population can affect future business growth in the region. The population in Upper Norrland is ageing rapidly with local fertility rates that are below natural replacement rates. As depicted in Chapter 2, in 2019, the share of population above 65 years old over the work age population in Upper Norrland (37%) was above Sweden's average (32%). Within the TL2 regions, Norrbotten has a higher share of elderly population than Västerbotten. Furthermore, Upper Norrland faces greater outmigration than the average of Swedish regions, especially in Norrbotten where the population has decreased 3% since 2000. In Upper Norrland, the mining municipalities in the region experience a larger population decline than the urban centres – in particular from young women. These demographic trends lead to local labour shortages and business competition to attract and retain talent. Furthermore, outmigration of the young population affects the local cultural life, weakening the mechanisms to integrate new inhabitants and migrants to the local community (OECD, 2017^[31]).

The expanse of land and sparse nature of human settlements bring some challenges in terms of stakeholder co-ordination and services provision. Low-populated municipalities covering large geographical areas has led to fragmented labour markets that struggle to create economies of scale in certain economic areas and face skill mismatches. Public programmes for business support or service delivery face challenges to reach out to the entire population and co-ordinate with nearby municipalities. Likewise, municipalities face challenges to share labour and business information, hampering labour mobility from municipalities with low to high unemployment rates. To deliver public services, the region has to succeed by implementing innovative mechanisms and leveraging digital solutions. The region has a strong platform based on good quality access to broadband that supports innovation in the aged care and health system. However, this digital approach for services has paid less attention to other policy services such as training, business advisory or spatial planning.

SMEs tend to be over-dependent on a few large mining firms and those outside the mining sector face difficulties for growth. The nature-based and small size of the market characterises an economy dominated by a small number of large firms focused on extractive sectors. Many of the SMEs and suppliers are located in the backward linkage of the mining value chain, i.e. in the provision of goods and services for mining exploration, exploitation or logistics, while just a few businesses are connected to forward linkages in the transformation of minerals or manufacturing of new metals. This dynamic has led to a market where many SMEs are locked into supplier relationships with a few large firms (OECD, 2017^[31]). For example, in Pajala Municipality, the main client of a large number of suppliers is the mine and this picture mimics Gällivare and other neighbour municipalities. The dynamic has also leads to a crowding-out effect in sectors outside extractive industries. New businesses can face extra challenges in accessing skill labour, infrastructure, financing and inputs, as many of these factors are focused or locked in extractive activities.

The capacity of infrastructure in both east-west and north-south corridors can be enhanced. Most mining companies in Upper Norrland, particularly in Norrbotten, rely on the rail network to Narvik, Norway, to export the production. Some mines far from a rail connection (e.g. Pajala mine) use trucks to transport ore to a railway station. Such transportation occurs via the county's main highways and roads, which are in many cases two-lane roads. A first policy of co-ordinating mining transport via these roads (allocating

specific times or days) or enhancing the routes would help to improve the flow of goods and people in the area. The labour market and exchange of goods should be boosted with improvement of east-west connections and links between northernmost municipalities with centres in the south of the region. Modern transport roads with Finland and Norway can also facilitate interaction with the mining sector in those countries. However, the national focus of transport planning for the north still prioritises north-south linkages (OECD, 2017^[31]). In this sense, the completion of the North Bothnia Line connecting Luleå (Norrbotten) with Umeå (the southern city in Västerbotten) with a high-speed railway will enable regional expansion and accessibility to larger markets.

The high reliance on extractive industries (mining and forestry) closely connected with global trade makes the region vulnerable to external shocks on the global economy. The recent crisis from the COVID-19 pandemic hit mining sectors – especially iron and base metals – harder given the drop in the demand from the manufacturing and construction industries. As in the 2008 crisis, this will affect local income and slow down investment and exploratory decisions from mining companies. These factors can particularly affect local businesses locked into supplier relationships with large firms. For this reason, diversification in terms of markets and economic activities is a pressing policy in the region, especially when it comes to small firms.

The table below summarises the main strengths and challenges for Upper Norrland’s mining ecosystem.

Table 3.2. Strengths and challenges of the Upper Norrland mining ecosystem

Strengths	Challenges
Sustainable and reliable green energy with low cost	An ageing and declining population
Universities and research centres with high expertise in metals or mining-related areas (space or renewable raw materials)	Sparsely populated area represents a challenge for stakeholder co-ordination and service provision
A large geographical extension rich in natural resources and unexploited mineral potential	SMEs locked into supplier relationships with a few large firms mainly focused on nature-based industries
Frontier companies in mining technology and equipment	Limited infrastructure capacity
A skilled and highly educated workforce	

Unlocking growth opportunities for Upper Norrland

Upper Norrland has the potential to position itself as a leader in technology development for environmentally sustainable mining. The region has a number of assets that can be mobilised to deploy new types of jobs and businesses linked to environmentally friendly technology. These include sustainable and reliable green energy, a pool of universities and research centres, frontier companies investing in mining technology and a highly skilled population. However, the region faces some challenges to consolidate a dynamic mining ecosystem and facilitate synergies with other economic sectors. They include a shrinking labour force, co-ordination challenges to support local businesses and labour mobility, and locked-in SMEs. This section will examine the regional strategies and policies to mobilise such assets while addressing the current challenges.

Snapshot of the regional development strategies in Västerbotten and Norrbotten

Regional development policies are instrumental to provide the vision of the type of development in the region, align actors and set the strategies to overcome development challenges. Effective strategic planning can also help reduce asymmetries of information, contribute to better functioning markets and create new markets where there are none (OECD, 2016^[31]).

In Sweden, the national government plays a strong role in shaping the strategic policy setting at the regional level. In the context of the OECD, Sweden has a relatively centralised approach to strategic planning and policy development (OECD, 2017^[3]). The Ministry for Enterprise and Innovation is the national body responsible for regional and rural development as well as state-owned enterprises, enterprise and industrial policy. The Swedish Agency for Economic and Regional Growth, a part of this ministry, is in charge of managing the European Regional Development Fund (ERDF).

At the regional level, both Västerbotten and Norrbotten regional councils conduct economic strategies by setting out the vision, goals and priorities for sustainable development. These economic strategies are based on the overall vision of the EU and national level strategies, in particular the policy priorities set by the National Strategy for Regional Growth.

Both TL3 regions in Upper Norrland have well-defined development strategies aiming to mobilise its main competitive advantages. The two regional strategies put a strong focus on quality public services, innovation and entrepreneurship, transport and digital connectivity, and educational attainment.

Västerbotten Regional Development Strategy 2014-20 identified six policy priorities for creating a sustainable, attractive region from the coast to the mountains (Table 3.3). Västerbotten identifies mining as an engine to support regional development with a focus on long-term sustainable growth. It recognises the capacity of mining ecosystem know-how (expertise from universities, businesses and the engineering sector) to develop products and processes based on renewable raw materials. A concrete strategic goal is to unlock the local expertise to consolidate the region as an international model in clean-tech.

Västerbotten is currently developing a new strategy for the period 2020-40. This long-term plan is under discussion with a range of stakeholders and will have a stronger link with the Sustainable Development Goals. The new plan defines nine targets with the aim to adapt the region to the future technological changes and accelerate the transition towards a zero-carbon economy. The goal of a sound circular economy process and the use of fossil-free materials and infrastructure have a central role in the policy agenda.

In Norrbotten, the regional council has defined the Regional Development Strategy 2030 through co-ordinated work with regional actors. This is a cross-sectoral strategy that identifies four main objectives to enhance attractiveness and innovation (Table 3.3). The strategies are very much in line with global, EU and Swedish strategies for sustainable growth. A main goal for the 2030 development strategy is to enable an environment for innovation and entrepreneurship. It recognises the region's need to diversify the economy and reduce vulnerability to cyclical changes and technological shifts. To move forward this ambition, the strategy identifies the transition to a circular economy as an opportunity to create new business, supported by policies to scale up SMEs and promote open innovation entrepreneurship.

The regions have also defined a number of areas to unleash growth opportunities and create complementarities. This strategy focuses on unlocking opportunities from the region's competitive advantages, namely the nature-based economy – minerals and forestry resources – and the energy infrastructure. It supports knowledge dissemination and diversification among related sectors as a mechanism to promote innovation.

Västerbotten and Norrbotten smart specialisation strategies have identified a number of areas to make the most of the existing potential in the region (Table 3.4). Västerbotten's innovation strategy (2014-20) focuses on seven areas, including healthcare and medical technology and bioenergy. In the case of Norrbotten, the innovation strategy (2019) defines five areas of specialisation to unlock opportunities from the nature-based economy – minerals and forestry resources – and the energy infrastructure. These strategies aim ultimately to support knowledge dissemination and diversification among related sectors as a mechanism to promote innovation.

Table 3.3. Development objectives of Västerbotten and Norrbotten

	Objectives	Examples of strategic actions for each objective
Västerbotten	<ol style="list-style-type: none"> 1. Promote communities that include and develop their residents 2. Develop structures for innovation 3. Environment-driven development 4. Investment in education and skills 5. Location-based business development 6. An accessible and outward-looking region 	<ol style="list-style-type: none"> 1. Collaboration and new solutions for services 2. A co-ordinated regional innovation support system with strong stakeholders 3. Increased production and relative use of renewable energy 4. Increased proportion of students who graduate from upper secondary school 5. The internationalisation of SMEs 6. Improved system functions and capacity within the transport infrastructure
Norrbotten	<ol style="list-style-type: none"> 1. Be welcoming, durable and attractive 2. Create sustainable accessibility 3. Have a well-functioning skills supply 4. Be innovative and competitive 	<ol style="list-style-type: none"> 1. Increased participation and basic community services 2. A change in transport for a more sustainable society 3. Improved skills provision through lifelong learning and broadened educational offerings 4. Strengthened entrepreneurship and enterprise

Source: Västerbotten Regional Council (2013^[32]), *Västerbotten Regional Development Strategy 2014-20*; Norrbotten Regional Council (2019^[33]), *Norrbotten Regional Development Strategy 2030*.

Table 3.4. Areas of specialisation in the Norrbotten and Västerbotten innovation strategies

Västerbotten	Norrbotten
Innovations in healthcare – Product and service development	Arctic test vehicles for Europe – The Arctic climate and sparsely populated areas create opportunities for testing technology
Life Science – Support the industry in pharmaceuticals, biotechnology and medical technology	Energy technology – Increase competitiveness, by promoting sustainable energy use and energy supply based on renewable energy sources
Technological and service development in industry – Boost the competitiveness of SMEs by leveraging on the industry's demand for technology and service development	Space technology – Space exploration provides Sweden and the EU with the tools to address global societal interests, such as climate change, migration, mobility and energy security
Test activity – Using the region's natural conditions, competency and technological advances to promote testing and exercise	Cultural and creative industries – Broaden the business structure and cultural and creative industries (communication, design, architecture, music and sound, film and television)
Sustainable energy and environmental technology – Investments in bioenergy production	Tourism – The region's nature, culture and history, combined with the development of good communications, provide good opportunities to create high-quality products and experiences
Experience cultural and creative industries – The conditions for further developing the creative industries	
Digital service industries for the smart region – There is a great opportunity for the development and implementation of new products, applications and systems for widened information and communication technology (ICT)	

Source: Västerbotten Regional Council (2013^[32]), *Västerbotten Regional Development Strategy 2014-2020*; Norrbotten Regional Council (2019^[33]), *Norrbotten Regional Development Strategy 2030*.

Both regions share the interest of becoming a world-leading region in testing technologies. The cold climate of Upper Norrland with excellent areas for winter testing and a stable winter climate with negative temperatures for several months offer attractive test environments for the automotive, train, wind power and aircraft industries, new composite materials, wind power plants, rail vehicles and a wide range of future solutions. Currently, the testing of vehicles in cold climates has become one of the most important

industries in Norrbotten. Those similarities open opportunities to further explore common strategies in this area.

Other areas of great complementarities are culture, creative industries, tourism and the space industry. Tourism has seen the fastest growth in the region and the Sami culture together with an Arctic lifestyle (northern lights and midnight sun) and the sky resorts pull in an important number of tourists yearly. While this sector suffered a drop due to the pandemic crisis of 2020, particularly from international tourism. Policies to attract international tourists are going to be crucial for the recovery of the sector in the years to come.

The region also benefits from a dynamic creative industry including design, architecture, music/audio, film, literature, photo and games. This can create a positive environment to retain and attract new skills and talent. Furthermore, a close collaboration between the mining and space industries can further unlock new growth opportunities for the region in terms of development and use of new materials or technologies.

The regional development strategies have set mining as a driver for innovation

When it comes to the future of the mining industry, the strategic plans of Västerbotten and Norrbotten acknowledge the potential of local assets to develop new technologies and practices to support environmentally sustainable mining. The mining ecosystem is seen as a platform to add innovation and potentiate other economic activities by enhancing the involvement of technological development process on raw materials with the rest of the economy. For this, the strategies have set a number of actions that can be complementary.

Västerbotten aims to increase the value-added of natural resources and resource-efficient technologies. For this, the region is supporting investments in technology, professional development and production methods that promote sustainable development. A clear strategic programme for this is the development of fossil-free materials and minerals, system solutions for the commercialisation of biorefineries as well as information technology (IT) systems that reduce energy consumption.

Norrbotten development strategy acknowledges the vulnerability of being too dependent on the mining industry as cyclical technological changes in the world can quickly have major effects. The strategy aims to keep the focus of research on its natural resources (ore and minerals, forests and hydropower) to complement the extraction of unique raw materials to contribute to the global sustainability agenda and European competitiveness. The strategy also intends to benefit from natural resource technology innovations to promote research in digitalisation, space and artificial intelligence.

Norrbotten and Västerbotten development strategies can better identify the specific actions to strengthen the local value chain on mining and promote mining clusters. A common approach in the development strategies is leveraging on mining innovation to support other industries. However, little attention is given to how to foster a more competitive mining ecosystem. Strategies to support a clear integration of actors in the mining sectors can very much benefit both regions in consolidating a single cluster of innovative mining technologies and practices.

In sum, both regional strategies could better align their growth priorities to exploit synergies and build a common vision for Upper Norrland. Both strategies target similar industries (testing industries, energy technology or creative industries) but there is no clarity on the type of co-ordination to meet common objectives. Co-ordination in strategic implementation can also lead both regions to benefit from economies of scale and knowledge exchange. Furthermore, clarifying a common future for mining development in the region could also help to design specific policies to reach similar objectives and move forward a common agenda that leverages on mining technology. Such common strategy has to be built upon the development of a functional mining ecosystem to position Upper Norrland's competitive advantages internationally and create a diversified and sustainable economy. The next section will offer a strategic orientation and set of

policy recommendations to unlock the potential of the mining ecosystem and address the challenges for a sustainable future for people and businesses.

Mobilising regional assets to become an international benchmark on environmentally sustainable mining

Upper Norrland can leverage the assets of its mining ecosystem to become a model in environmentally sustainable mining. If well managed, this technological progress can offer the opportunity to position itself as the technology provider for the Arctic region, which will help diversify the economy and provide a sustainable future development for its people and businesses.

As presented in the previous sections, Upper Norrland is already moving forward in developing technology to reduce the CO₂ footprint in the mining and metal making process. Innovative large mining and extractive companies along with the skilled labour force and the industrial partnership with universities can lead to first-class innovations to attain a zero-carbon emission mining process and reuse of waste mining. The regional strategies in Upper Norrland also target this overall objective to attain sustainable growth based on an innovative mining and mineral processing industry. This strategy is valuable to complement the international efforts to transition to a zero-carbon economy, where many green technologies (electric batteries, solar panels, etc.) and rare metals to build them will be increasingly required.

The undergoing innovation efforts in mining also provide the scope for Upper Norrland to become the know-how and technological provider for the Arctic region. Many of the technological solutions developed by mining companies address common challenges faced by industries operating in the arctic environment. The climate characteristics in the north (low temperatures in winter and long days in summer) coupled with the shortage of easy-to-access mineral deposits require the use of adapted machinery and equipment (i.e. adapted trucks or ventilation systems). The technologies underproduction can contribute to developing the mining industry in other Arctic countries. Furthermore, the initiatives of producing fossil-free materials can also contribute to attaining environmental agendas in other industries. Industries are also looking for strategies to make their products more environmentally friendly. For example, the space industry in Kiruna is conducting a project to build more environmentally friendly engines. In a near future, automobile manufacturers might increase the offer of cars made with zero-carbon materials, responding to increasing environmental regulations and a more conscious demand (Hertwich et al., 2019^[34]).

To become a reference in technologies for sustainable mining and support a more diversified economy, Upper Norrland needs to ensure all actors can benefit from innovation activities and address labour market challenges to enhance well-being for communities and growth opportunities for local businesses. For this, Upper Norrland needs to:

- Develop an innovation policy approach that enables synergies among the mining sector and the local economy.
- Improve the co-ordination within regional actors to improve the local labour market and business environment.
- Enhance regional and international co-operation to consolidate a unified vision on mining development between Västerbotten and Norrbotten.

Developing a broad innovation ecosystem by including municipalities and local businesses

Upper Norrland is considered a highly innovative region in the national and European contexts (Chapter 2). The TL2 region has particularly evolved in terms of technological innovation, mainly driven by the mining industry. This important asset positions the region to enable it to reach technological frontiers and become an international model on this matter. Non-technological aspects of the innovation can also be further exploited. The OECD/Eurostat Oslo Manual acknowledges a broader role of innovation, from product innovation to business process and social innovation (OECD/Eurostat, 2018^[35]).

In Norrbotten, large mining companies are driving the technological innovation process. LKAB plays a key role in leading innovation in the TL2 region by gathering other companies' expertise around the projects on zero-carbon mining process and mining recycling as well as offering its mines as a testing platform for equipment manufacturing companies. Such innovation leadership has led to important technological progress in mining automation and new production processes for raw materials. However, this innovation process has followed a mostly in-house development approach, involving selected research centres, innovative suppliers and equipment manufacturers, but low interaction with local SMEs and municipalities.

Becoming an international provider of technologies for environmentally sustainable mining will require an innovation process that involves all local actors. Despite the comprehensive innovation policies of the two TL3 regions, which address opportunities among different economic sectors (see the previous section), the regions have scope to improve the co-ordination and the mechanisms to implement the innovation strategy across municipal governments and local business. For this, Västerbotten and Norrbotten regional councils should:

- Better integrate local governments with the innovation process of universities and firms.
- Increase the innovation and the absorptive capacity of local firms.
- Strengthen the implementation of smart specialisation strategies with a cluster approach on mining.

Involving local governments in the innovation system

Upper Norrland's private-driven technological approach for innovation requires better co-ordination with regional and municipal strategies. Today, private-led innovation has a weak involvement with development or investment strategies of municipal governments. The technological ventures in local communities can offer key opportunities to create a larger innovative ecosystem involving customers, service providers and governments. To create the synergies with the local economy, the in-house projects from mining companies need to be aligned with the strategic projects at the municipal level. For this, the regional councils should formalise the co-operation between municipal governments and mining companies around innovation projects. This can be done through periodic meetings open to local businesses and research institutions.

Promoting open or user-driven innovation can contribute to balanced growth across different municipalities in the region. Not all municipalities in Upper Norrland are benefitting from the innovation process driven by the extractive industries. Municipalities with no mining or forestry activities have relied mainly on services or tourism to remain competitive, leading to a different innovation and growth path. To extend the innovation outcomes from the mining industry to the whole region, Upper Norrland can put a stronger focus on innovation diffusion mechanisms. Many OECD regions have moved towards open or user-driven innovation, acknowledging that innovation diffusion (and not just knowledge creation) is key to productivity and employment growth (OECD, 2019^[36]). Policies to promote innovation diffusion from frontier companies to all municipalities can unleash new business ideas and support economic growth across Upper Norrland. For this, regional councils should also involve non-mining municipalities in the co-operation on innovation with mining companies.

Upper Norrland has scope to improve the co-operation on innovation between academia and the public sector. Universities can also play an important role to strengthen the innovation strategies and capacities of municipal governments at the same time as improving the impact of research projects. While the regional innovation process has benefitted from a close co-ordination between academia and industry, the interaction of universities and research centres with the regional and municipal strategic priorities remains low. Both regional and local governments have fewer spaces to collaborate with the undergoing research projects carried out by mining companies and universities. The lack of involvement in the innovation system is particularly high in municipalities that are far from university campuses. Furthermore, municipal governments tend to lack the skill capacity to benefit from innovation partnerships, due to staff shortage and lack of appropriate skills. To improve the co-operation on innovation, the regional councils of the

two TL2 regions should promote formal partnerships with universities for strategic development. The regional councils can get inspiration from the partnership between Karlstad University and Region Värmland to support regional development (Box 3.6).

Box 3.6. The Academy for Smart Specialisation

The Academy for Smart Specialisation aims to utilise research for the benefit of industry, the County Administration, the County Council, and the municipalities in Värmland, and to strengthen the research environments in the region. High-quality research is expected to attract more external funding to the university.

This initiative is a continuation of the agreement of intention that was made for the period 2010-14 when ten new professorships were instituted at Karlstad University. This project also involves research co-operation and will go on till the year 2020.

The six areas of specialisation identified by Värmland's research and innovation strategy are the foundation of the Academy for Smart Specialisation. Karlstad University and Region Värmland will run the academy jointly for the purpose of serving as a meeting place for researchers, companies, financiers and entrepreneurs. By linking research innovation and education, the academy will prepare Karlstad University students for employment to drive the industrial development in the six prioritised areas in Värmland.

Source: Karlstad University (2020^[37]), *Academy for Smart Specialisation*, <https://www.kau.se/en/external-relations/research-and-innovation-collaboration/research-collaboration/academy-smart> (accessed on 15 February 2020).

Increasing innovation capacity of SMEs to promote diversification

Small businesses are often a driving force of innovation and knowledge diffusion and contribute to the empowerment and inclusion in society (OECD, 2017^[3]). However, across OECD countries, small firms tend to find larger barriers to absorb new digital technologies. OECD research shows that the uptake and diffusion of digital technologies and activities are much lower among SMEs than among large firms (OECD, 2019^[36]). SMEs also tend to get involved in “doing, using and interacting-based innovation” (DUI) rather than “science and technology-based innovation” (STI). Common barriers include a shortage of skills or staff to keep up with technological progress and low capacity to access funds to update technology. Further, in mining regions, an overreliance on mining can reduce the incentives for SMEs to participate in the regional innovation programmes and diversify their business.

The promotion of SMEs is a key aspect in the development strategy of Upper Norrland. Both TL3 regions have developed specific strategies to internationalise and increase innovation in SMEs. Norrbotten and Västerbotten have a number of support mechanisms to promote the innovation capacity of SME. It includes co-financing projects to increase collaboration of SMEs with academia and research industry as well as grants for innovation, digitalisation and internationalisation. In Norrbotten, a key policy is to extend the survivable rate of entrepreneurs and SMEs by promoting the intake of digitalisation. The region has an incubator in Luleå and incubators for cultural companies in some municipalities (Norrbotten Regional Council, 2019^[33]). In Västerbotten, main policies target greater participation of local firms in international networks and fairs and the deployment of science parks with local and/or virtual nodes throughout the region (Västerbotten Regional Council, 2013^[32]).

The innovation strategy in Upper Norrland needs to further involve and ensure sustained participation of mining and non-mining SMEs. Despite the SME programmes and support in Upper Norrland, many small and micro companies lack interest in innovation and digitalisation programmes or have reduced capacity

and time to participate in them, which make it difficult for the innovation strategy to sustainably engage a representative share of SMEs (OECD, 2017_[3]). To address this challenge, regional councils should:

- Enhance work with universities to boost the entrepreneurship culture, especially involving women.
- Collaborate with mining and innovative firms to facilitate technology transfer to SMEs.

When it comes to an entrepreneurial culture, regional councils can leverage on universities and training to foster entrepreneurship. Common policies in OECD countries to boost an entrepreneurial culture include entrepreneurship courses in education programmes, improving information and mentoring activities as well as reducing the negative social consequences of business failure (OECD, 2017_[38]). Regional councils can learn from intentional experiences to develop information campaigns to raise awareness about entrepreneurship (i.e. France) or provide financial support and insurance guarantees to entrepreneurs that are active or already failed (i.e. Portugal). In Upper Norrland, these strategies should be coupled with joint work with educational institutions at all levels by integrating entrepreneurial courses into the curriculum of these institutions and training for wage-earning employees. Given the increasing need to retain and attract women, these programmes should have a special focus on women by developing particular networks and targeted training courses (Box 3.7)

Box 3.7. Fostering women's entrepreneurship

The implementation of targeted policies and programmes to support women's entrepreneurship and self-employment can be put forward, considering that women are under-represented in entrepreneurship in comparison to men and closing the gap would result in welfare gains. In addition, there is evidence that women are held back in entrepreneurship by institutional and market failures, including discouraging social attitudes. Finally, there is some evidence that women have a lower awareness of public support programmes and that intake mechanisms favour male entrepreneurs. However, policy can support women entrepreneurs by:

1. **Promoting a positive attitude through role models and ambassadors:** Role models can play a crucial role in developing an entrepreneurial spirit and have demonstrated an ability to influence an individual's entrepreneurial propensity through positive representations.
2. **Developing entrepreneurial skills through training courses and mentoring:** Training programmes for women usually provide the same content as mainstream courses. However, there is evidence that women-only programmes are more effective and intake mechanisms for mainstream programmes can potentially be gender-biased since they may not account for the different characteristics and needs of women entrepreneurs (i.e. women are often excluded from growth-oriented programmes because women-owned businesses are traditionally smaller).
3. **Facilitating access to finance through financial literacy and a range of financial institutions:** Policies to support entrepreneurs in accessing financing are rooted in addressing market failures, including information asymmetries and financing gaps. For women entrepreneurs, offering microcredit is common.
4. **Building entrepreneurial networks and ensuring linkages to mainstream infrastructure:** Networks for women entrepreneurs should not reinforce gender differences by isolating women from mainstream business service providers and other stakeholders from other communities. A common approach to building networks is to create them around other policy interventions such as training or other business development services.
5. **Promoting work-life balance and access to social protection:** First, family and tax policies should support women's participation in the labour market in general. Historically, public policy

related to women and families targeted their protection almost entirely focused on women as employees but policies need to be adapted to self-employment.

Women's Enterprise Centre Initiative, Canada

The network of Women's Enterprise Centres (WECs) was established in 1994 as an effort to better address the challenges faced by women entrepreneurs. WECs are present in each of the four provinces of Western Canada, are operated by not-for-profit organisations and are awarded five-year renewal contracts to offer advice, business planning assistance, mentoring, networking opportunities, information and referrals to accountants and lawyers, specifically to women. They also deliver loan funds targeted to new or existing businesses owned by women. The WECs have provided a one-stop-shop for women entrepreneurs.

Some of the most significant impacts achieved by this programme have been: further developing their business, management and personal skills; increasing their access to other programmes and services through information resources; and enabling them to network. The impact of the loan programme was also significant. Overall, clients attribute 55% of their current business revenues to the services provided by WECs.

Source: OECD/EC (2017^[39]), (2017), "Policy brief on women's entrepreneurship", <http://dx.doi.org/10.2767/50209>; OECD (2013^[40]), *Mexico: Key Issues and Policies*, <https://doi.org/10.1787/9789264187030-en>.

Alongside this, joint work with universities can also enhance micro companies' participation in innovation systems. In some OECD regions, a closer co-operation with academia allows the small companies that are not able to finance an internal research facility to leverage cutting-edge research equipment, techniques and workforce from universities and public research institutes (OECD, 2019^[41]). As many small companies struggle with innovation in science and technology, this type of partnership can provide them basic tools to accelerate DUI innovation. The regional council should expand the existing programmes that promote co-ordination among academia and SMEs to all sizes of companies and women-led SMEs. It can be done by supporting small and micro companies to access training (i.e. managerial training via webinars or personal counselling) and universities' research equipment and staff. Targeted loans or regional vouchers to non-repayable grants can also complement this partnership with education institutions (Box 3.8) (OECD, 2019^[41]).

Box 3.8. Involving SMEs in the innovation ecosystem

The closure of 13 Limburg coal mines in the early 1970s triggered a process of regional innovation system thinking, which has become the guiding paradigm for regional development policy in the province. Limburg was one of the first of four Regional Technology Plan (RTP) pilot regions in Europe. It completed its plan in 1996 and followed it up with a Regional Innovation and Technology Transfer Strategies and Infrastructures Plan (RITTS), a Regional Innovation Strategy (RIS) and a smart specialisation strategy (S3) as of 2014. Limburg is classified as an innovation leader in Europe based on a sustained approach to internal and external collaboration, partnerships and implementation. Limburg is focused on developing its innovation system to include more integrated themes, better address sustainability issues, implement improved governance processes and create evidence-based information (e.g. R&D/patent information) for strategy building.

A particular innovation emerging from Limburg's experience is the use of innovation vouchers – a concept pioneered by Limburg in 1997. This first pilot explicitly aimed at encouraging knowledge transfer and building collaboration between SMEs and research institutions. The goal was to encourage,

advice and support SMEs in Limburg as they undertook measures to maintain or improve their competitiveness in the domestic and international markets. The project's target group was SMEs located in Limburg with 15-250 employees and DSM Research, a private research and development campus where vouchers could be utilised.

Source: OECD (2019^[41]), *OECD SME and Entrepreneurship Outlook 2019*, <https://dx.doi.org/10.1787/34907e9c-en>.

Large extractive and mining manufacturing companies can further improve the innovation capacity of small supplier firms in Upper Norrland. In the region, many of the small firms involved in supply relationships with the mining companies are family businesses or single-owner companies, focused on services (i.e. maintenance, cleaning). This is especially the case of the northernmost municipalities where large firms leverage local markets to obtain basic products and services. This small-size and family-oriented nature of the companies creates capacity barriers to develop appropriate skills and free up time to get involved in innovation exchanges (i.e. new managerial approaches) or embracing new technologies (new tools and installing technologies). In OECD countries, large firms have been supporting suppliers and associated SMEs through a number of partnerships, including deploying specialised accelerators for start-ups and individuals, setting up innovation labs with a view to encouraging “out-the-box” thinking and new collaborations within the firm (OECD, 2019^[41]). Upper Norrland should further facilitate or collaborate with large firms to develop capacity programmes for suppliers – especially targeting less involved segments of the population such as women-led SMEs or entrepreneurs. They can take the form of accelerators or open lab collaboration. The example of the BHP accelerator programme for suppliers in Chile is a guiding practice (Box 3.9).

Box 3.9. Upgrading local suppliers

Successful supplier development programmes have helped to create clusters of firms that provide goods and services to the mining sector. Such programmes can emerge from the private sector initiative to improve the quality of inputs and improve social acceptance from the local community. These types of programmes are boosted with co-operation of government agencies to reach the right scale and ensure sustainability. The programmes increase capacity and employment in local SMEs, create deep linkages and foster innovation, transfers of technology and business process knowledge.

BHP Billiton created the World-Class Supplier Programme

In 2009, BHP Billiton created the World-Class Supplier Program in Chile to address the competitiveness challenges jointly with local suppliers and create a more sophisticated and export-driven economy in Chile. The programme has successfully introduced standardisation across operations and is continuing to develop the knowledge-intensive expertise of local suppliers. This latter outcome is further serving to reduce Chile's economic vulnerability to commodity market shocks. The success of the programme attracted Codelco, the public mining company, to join in 2010.

The mutually beneficial programme set the goal of creating 250 world-class mining suppliers in Chile by 2020. The programme focused on five areas: water, energy, HSEC (health, safety, environment and community), human capital and operational efficiency.

The methodology of the programme is seeking tenders from local suppliers on problems or challenges identified at the operational level – rather than prescribed solutions – and using a framework to test ideas in real time. BHP has also partnered with the government of Chile and Foundation Chile (a public-private partnership that promotes innovation) to better leverage support for the new suppliers. In the

first 3 years of the programme, over 100 innovation projects were submitted for consideration, 20 of which led to contracts with BHP Billiton.

Source: BHP Billiton Chile (2013^[42]), *BHP Billiton Pampa Norte Minera Escondida*, <https://www.bhp.com/-/media/documents/community/2014/csr-eng150518sustainabilityreport2014bhpbillitonchileoperations.pdf>.

Finally, an important strategy to support the goal of becoming a key player in sustainable environmental technologies is to strengthen the environmental practices of SMEs and suppliers. Ensuring environmental good practices across the local mining value chain will help to strengthen the perception of the environmentally friendly mining industry. Thus, it is an important mechanism to position internationally not only the final product (i.e. iron pellets and technologies) as environmentally friendly but also open up opportunities for small suppliers to export their knowledge and practices on this type of green provision of inputs to their mining industries. Hence, the region should support small businesses already integrated into local (and global) value chains to transition to environmentally friendly practices and technologies. The former accelerator programme for suppliers can include a stronger focus on these practices.

Strengthening the implementation of smart specialisation strategies

Regions are seen as increasingly important to the delivery of innovation policy outcomes, particularly in terms of the idea of “smart specialisation” (OECD, 2018^[43]). Smart specialisation strategies aim to strengthen regional competitiveness by identifying and prioritising areas of potential growth. The role of the government in this strategy is helping the private sector and entrepreneurs to identify their knowledge-based strengths at the regional level through a range of mechanisms, including public-private partnerships, technology foresight and road mapping. The success of smart specialisation policy is closely dependent on the capacity of regional government institutions to act as co-ordinators or facilitators of the innovation process.

A key challenge for Västerbotten and Norrbotten is to operationalise the smart specialisation strategy. TL3 regions lack clear tools to implement the strategy in a co-ordinated fashion with municipalities and local actors. The implementation of the strategy is conducted mainly on a project-basis approach rather than following a concerted strategy. Some specialisation strategies (i.e. technology development for sustainable mining) are mainly driven by private actors or universities, with a low degree of joint planning with local municipalities. Larger distances also make it harder to establish a constant exchange with municipalities around the implementation and monitoring process of the strategy. Constant engagement with local actors is crucial to maintain trust and commitment as the strategic projects established in the smart specialisation can vary and modify with the time (Gianelle et al., 2016^[44]).

To align all actors in the implementation strategy, the Norrbotten and Västerbotten councils need to assume a more active role as a broker to facilitate innovation. Facilitating a constant dialogue and engagement among local actors is especially needed in sparsely populated areas, where the physical distance among municipalities can lead to pursue individual approaches and lose co-ordination with time. To maintain a constant commitment, both regional councils should establish an institutionalised platform to monitor the implementation of the strategy and ensure the continuous engagement of different actors through regular meetings under a formalised setting. The region has already a similar type of platform – Georange – that focuses on mining and mineral development. The region can follow the model of this sectoral platform to create a broader platform – that also involves civil society representatives – to implement the smart specialisation strategies of the main regional competitive advantages (tourism, space industry, etc). The example of Lapland can also help guide the strategic approach of this platform (Box 3.10).

The regional councils can further leverage on Georange organisation to move the innovation strategies in the mining and minerals industry forward. Georange is a well-conceived organisation that provides the mechanisms to align the interests for mining development across the private sector, research institutions, universities and governments in both Norrbotten and Västerbotten. Researchers have found that a cluster of economic activities around mining ventures can lead to innovation and economic diversification, becoming hence an important instrument to provide socio-economic benefits to a region (Söderholm and Svahn, 2015^[9]). This type of cluster policy is a powerful instrument to channel funding for and follow up on the implementation of innovation strategy in mining. For example, the batteries cluster in Skellefteå will largely benefit from network creation through this organisation. For this, both regions should use the platform to agree on a common vision for the future development of mining (i.e. Upper Norrland branding) and linking with actors of other economic sectors and civil society to unlock growth opportunities.

Box 3.10. Implementing the smart specialisation strategy through clusters

Lapland's Arctic Smartness cluster

The Lapland's Arctic Smartness cluster collaboration is headed by the Regional Council of Lapland. This cluster has increased awareness of the expertise and specialists in Lapland and created new opportunities for introducing developed products and services to the market.

The collaboration between enterprises, educational and research institutions, the public sector and financiers is a key element in the cluster work. The clusters of Lapland have seen significant development in the past few years. New goals in Lapland strongly emphasise the emerging industries in the area and needs of business life. This steadily advancing locomotive is being steered by new and innovative industries. In addition, growth has been seen in the traditional mining and tourism industries.

The Arctic Smartness collaboration guides the clusters and implements smart specialisation in Lapland. The Geological Survey of Finland (GTK) and the Natural Resources Institute Finland (LUKE) have obtained a stronger role in the region. Together, Arctic Smartness stakeholders have increased the international visibility of Lapland.

The actors working the business interface, namely Digipolis, ProAgria Lapland and Rovaniemi Development, create service concepts. The University of Lapland and Lapland University of Applied Sciences provide innovation platforms and learning environments as meeting points for business, education and research.

Source: Arctic Smartness (n.d.^[45]), *Homepage*, <https://arctic-smartness.eu/> (accessed on 15 February 2020).

Furthermore, there is scope to better channel national innovation funds with the strategic priorities in the region. The OECD (2017^[3]) finds that opportunities related to innovation in Upper Norrland, as in northern Swedish regions, are not adequately reflected in the prioritisation of innovation investment at a national level. As national policies are designed to be applied across the national territory, the policy does not take sufficiently into account the specific characteristics in northern areas in regards to the more densely populated areas in the south.

Greater involvement from local actors to set the priorities of European funds can contribute to sustained implementation. There are three EU funds relevant for regional development in Sweden: the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the European Agricultural Fund for Regional Development (EARDF). From the ERDF budget 2014-20, around 65% of the funding for Upper Norrland focused on SMEs, whilst about 25% focused on infrastructure (OECD, 2017^[3]). In terms of the ESF, around 70% focused on promoting employment and labour mobility. Other OECD work has

found that these funds can help promote co-ordination and the realising of policy complementarities among different levels of governments in northern sparsely populated areas in Sweden (OECD, 2017^[3]). Both regional councils should further leverage on these funds to align municipalities, universities and local businesses with the innovation strategy.

A better co-ordination to create an attractive environment for people and businesses

The success of Upper Norrland as a region relies on a co-ordinated action to implement its development plan across the territory and address common challenges. Supporting municipal governments to overcome local challenges in the labour market and attract investment and people is key to achieving the desired policy outcomes for the population.

Improving co-ordination among municipalities for a better business environment and labour market

Better co-ordination among municipalities can contribute to address the shrinking labour force trend and support local business. Upper Norrland municipalities, in particular more remote ones, face structural challenges to support the development of the local market, including a lack of staff capacity and fragmented information on business and labour. These challenges are more acute with the increasing demographic pressure brought by ageing and outmigration (Chapter 2). Furthermore, a larger co-ordination among municipalities to expand the local offer of products and services will help retain locally the economic benefits from mining operations. The indirect impacts of mining ventures (better known as multiplier effects) are more likely to remain in the region if the local market is big enough to fulfil the demands of labour and goods (Söderholm and Svahn, 2015^[9]).

In Upper Norrland, the sparse nature of the region has led to small municipal governments that cover large geographical areas with a rather small population. On top of that, municipal governments have scarce financial resources, which make it difficult to compete with the private sector for skilled workers. While the challenges for development are similar across municipalities (i.e. labour market shortage), there are no co-ordinated strategies to implement joint policy solutions. Municipalities have developed individual and, in some cases, competing policy approaches to attract skilled workers, retain the young population or support entrepreneurship. It has led to a competing environment among local markets and prevented them from benefitting from sharing information and attaining economies of scale. Alongside that, information on business characteristics and needs has scope to be better shared across municipal governments for them to identify opportunities of collaboration on labour mobility and business development.

The above-mentioned challenges ultimately create difficulties for the municipal governments to be strong partners in developing the local business environment. Municipalities in Norrbotten have already promoted a type of development agency, generally in collaboration with private companies, to provide services to businesses and promote investment in the local market (i.e. Strukturum – the business corporation of Jokkmokk Municipality or Gällivare Municipality's Business Corporation). These municipal development agencies play a key role in supporting the implementation of the regional strategy and helping the municipality to identify its strategic priorities. However, these agencies face staff shortage and their effectiveness relies very much on the leadership and personal relationships of the person in charge. To address municipal fragmentation and improve the business ecosystem in the region, regional councils should establish a stronger co-ordinating mechanism that supports economies of scale, co-ordinates joint policies and centralises economic information. For this, the regions could establish a municipal co-ordinating body in the regional council to oversee and align the work of the different developing agencies and municipal governments.

Other OECD mining regions have also improved municipal co-ordination by creating an inter-municipal development agency. A unique development agency can integrate common strategic municipal tasks under one single agency and have the resources to hire skilled staff and find synergies among municipal

strategies through more efficient exchange of information. Finland offers an example of these kind of agencies. Business Joensuu Ltd in North Karelia is an agency from whom municipalities buy services according to a service agreement or Real Estate & Development companies in Varkaus area (Box 3.11). This agency was an instrument to build trust among municipal actors to conduct joint strategic projects and helped municipalities to feel that they gain more from co-operation in business development than from competition amongst each other.

The co-ordinating body needs to be the vehicle to address business challenges in a region with a shortage of labour force and small markets. This includes advice on ownership transition (in individually owned and family SMEs), developing and setting up a business (start-up, growth and mature phases) and funding opportunities. This co-ordinating body can also facilitate collaboration among municipal governments and the Platform for Regional Competency to improve the match of skills and focus on new job opportunities for women. It can also co-ordinate the implementation of smart specialisation strategies in Upper Norrland by involving local businesses and governments in the innovation process of large companies and developing internal and external networks for local businesses.

Box 3.11. Business Joensuu

At the beginning of the 21st century, smaller municipalities in North Karelia decided to set up a joint development agency to address some pressing challenges in the local market, including scarcity of resources, lack of special knowledge to handle the business advisory services and competition between neighbouring municipalities.

The municipalities negotiated on the City Board level with all municipalities around the capital of the region (Joensuu) the creation a functional body, called Josek, organised on the level of the region around Joensuu.

In 2018, two municipalities decided to reduce the services acquired from Josek and developed in-house the advising services for businesses (keeping the access to project development and facilitation services). It induced to a reform in the development agency and to constitute Business Joensuu.

Business Joensuu provides services to start-ups, municipal growth, foreign investors interested in the region and internationalisation support to local companies. In addition, Business Joensuu produces an operating environment for different industries by creating the best conditions for companies to operate in the region of Joensuu.

The company is governed by a board of directors that is selected by the following institutions:

- The City Council of Joensuu.
- The University of Eastern Finland.
- Joensuu University Support Foundation.
- The North Karelia Educational Council Group Riveria.

In 2019, representatives from the above-mentioned institutions plus representatives from the National Coalition Party and private companies (Outokummun Metalli Oy, Blancco Oy) formed the board of directors.

The service areas of Business Joensuu include:

- Business growth and development services.
- New businesses, businesses and internationalisation services.
- Placement and attraction, marketing services.

- Space, community and event services for the science park.

Overall, the company managed 25 programmes focused on different sectors including export capacity in the region (ExportGrowth), the bioeconomy sector (Digital Forest Vitality), business digitalisation (Joensuu Smartcity, digital training) and entrepreneurship (women's entrepreneurship). It is also involved in two active EU programmes to support the mining sector (MIREU and REMIX).

The services are typically 1-3-year-long customer-oriented development projects. They are initiated by designated industry-responsible experts who are responsible for promoting the business environment of their businesses, starting with the business needs of their companies

Source: OECD (2019^[46]), *OECD Mining Regions and Cities Case Study: Outokumpu and North Karelia, Finland*, <https://dx.doi.org/10.1787/cd72611b-en>.

Strengthening the collaboration to upskill the workforce and address the shrinking labour force

An ageing population and outmigration can negatively affect future labour force dynamics and public service delivery (OECD, 2017^[3]). To support the transition towards new economic activities linked to green technologies and meet industry demands, Upper Norrland needs to ensure the supply of labour with the right skills is in place. The region currently faces challenges to fulfil the labour demand on some basic and advance competencies (Norrbotten Regional Council, 2019^[33]). For example, mining companies in some municipalities find it hard to find electricians and there is a lack of workers in battery manufacturing, which can hamper the development of an eventual cluster of batteries in Skellefteå. Furthermore, automation in mining and extractive industries poses a high risk of job displacement, which requires target policies to upskill Upper Norrland's labour force, especially the most vulnerable workers (Chapter 2).

Attracting workforce into Upper Norrland

Both regions in Upper Norrland have developed a number of strategies to attract new residents. These include attracting immigrant to address labour shortages and the improvement of local attractiveness. Both TL3 regions pay particular attention to delivering quality public services. Through a co-ordinated approach between the region and municipal governments, both TL3 regions have deployed good ICT infrastructure that has set the basis for deploying innovations in the education, health and care systems (e-Education, e-governance and e-Health) (OECD, 2017^[3]). However, there is a lack of co-ordination in programmes to retain workers and share information on the specific needs of skills at the local level (Regional Government of Norrbotten, 2019^[47]). Furthermore, the national institutional bodies that address these challenges work with reduced staff: the Platform for Regional Competence in Norrbotten has one worker and Västerbotten has a group of five employees.

A co-ordinated approach to migrant assimilation can further revitalise the labour market in the region with a skilled labour force. Given the harsh climate and young outmigration, immigrant integration with a long-term perspective of staying is a challenge in northern rural municipalities (OECD, 2017^[3]). Furthermore, refugees, asylum seekers and their families face challenges such as lack of appropriate qualifications and recognition of prior experience as well as lacking the sufficient proficiency in the Swedish language. The OECD (2018^[48]) outlines a number of actions for local governments that can contribute to greater integration of migrants in the local economy, making the most of their skills and in turn enhancing the local labour market (Box 3.12). In the case of Upper Norrland, the development of new technological projects can be an entry door to attract new skilled residents. The region can accelerate the integration of foreign-born workers into the market through work placements, job-matching services and support with skills assessment across rural municipalities.

A co-ordinated strategy to integrate migrants needs to improve information sharing mechanisms and collaboration with on-the-ground associations. Regional councils and municipalities should support a free exchange of information on migrants' skills and centralise the information in a single open platform to allow easy access for professional actors. Promoting partnerships between migrant organisations, unions and businesses can also help the assimilation of newcomers and facilitate its integration in professional and personal networks.

Box 3.12. Matching migrant skills with economic and job opportunities

The OECD (2018^[48]) identified 12 key evidence-based points to aid policymakers and practitioners in the development and implementation of migrant integration programmes, at the local, regional, national and international levels. One of these objectives focuses on matching migrant skills with economic and job opportunities by proposing seven key actions:

Activities on the demand side of labour integration

1. Improve matching between local labour needs and newcomers' skills by building a locally accessible database of newcomers' competencies.
2. Fight discrimination in the labour market. Enforcement of anti-discrimination legislation in hiring and at the workplace could be carried out through education and support programmes for local employers or the introduction of anonymous CVs.
3. Develop strong networks with the private sector to foster migrant integration.

Activities on the supply side of labour integration

1. Encourage employment orientation services to target migrants.
2. Offer integrated packages for entrepreneurship support (coaching, microfinance and strengthening of business networks).
3. Develop systems for the validation of professional qualifications.
4. Help migrants access the labour market through social enterprises.

Source: OECD (2018^[48]), *Working Together for Local Integration of Migrants and Refugees*, <https://dx.doi.org/10.1787/9789264085350-en>.

Partnerships among municipalities and education institutions can support the strategies to attract new residents into the region. Universities can pull in skilled and young population to the region and connect them with local businesses. Some authors have found that research universities can leverage knowledge-industry clustering to increase the wealth of an entire region by attracting highly educated people and drawing in private investment (Abel and Deitz, 2009^[49]). Other OECD mining regions such as North Karelia have conducted strategies to leverage the high quality of their educational institutions to pull in young people and families (OECD, 2019^[46]). The innovative mining environment in the region and the close link with universities like Luleå can be of interest for specialised researchers or students in this field. For example, some OECD regions have increased the promotion of industrial PhD programmes to link long-term research projects with industrial needs (OECD, 2010^[50]). Offering students greater possibilities to link with the local industry should facilitate a long-term integration with the region.

Preparing the labour force for technological change

Rapid digitalisation is transforming what people do in their jobs, how they work and the skills they need to remain in employment (OECD, 2019^[51]). The technological change and automation are able to replace some repetitive tasks and make some occupations redundant. At the same time, they create new types of

tasks, which require workers to have a new set of skills and knowledge (Chapter 2). The recent COVID-19 pandemic has placed high on the policy agenda the need to provide workers with skills to work digitally (or remotely) and transition to high-value-added service activities. Reaping the full benefits of digitalisation will ultimately depend on the ability of governments to develop a set of policies that help workers adapt to these changes and develop relevant skills to thrive in the digital world.

Norrbottnen and Västerbotten have set the upskilling of the labour force high on their development agenda. Both TL3 regions have defined measures to reduce the risk of young people leaving upper secondary school, for example by promoting meaningful leisure activities, and ensure employers take more responsibility for employees' lifelong learning through collaboration between workplaces and educational providers. Both TL3 regions need to pay special attention to upskilling the labour force in the manufacturing and extractive industries. OECD (2018_[52]) finds that jobs in rural regions with a lower share of service activities, low productivity and a high share of repetitive tasks face higher risks of job displacement. Economies with a high degree of specialisation in the manufacturing and mining sectors, such as Norrbotten, could then face important risks of job displacement (Table 3.5).

Box 3.13. Manufacturing and mining are among the top sectors at risk of automation

According to the OECD (2018_[52]), mining jobs are among the top five occupations in terms of jobs at risk of automation (Table 3.5). Automation is likely to reduce the number of operational jobs in mining such as drilling, blasting and train and truck driving. These areas typically constitute over 70% of employment in mines (Cosbey, 2016_[16]).

Table 3.5. Top five occupations in terms of jobs at risk of automation

Occupation (ISCO name)	Share of jobs at high risk of automation, average across TL2 regions (%)
Food preparation assistants	0.6
Drivers and mobile plant operators	3.5
Labourers in mining, construction, manufacturing and transport	2.2
Stationary plant and machine operators	2.6
Refuse workers and other elementary workers	0.8

Note: The table shows the five occupations that have the highest risk of automation as well as their share of total employment, average across TL2 regions in the sample

Source: OECD (2018_[52]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, <https://doi.org/10.1787/9789264305342-en>.

Upper Norrland can further capitalise on the close collaboration among companies and universities to upskill its workforce. The OECD (2018_[52]) has highlighted the importance of better engaging employers in skills development programmes to ensure that training programmes are well aligned with the skills needed by the local labour market and target the right key segments of the population – women and immigrants. For the young population, governments are promoting apprenticeship programmes along with on-the-job as well as off-the-job training to smooth the school-to-work transition. For the workforce population, facing automation involves policies that promote training at the workplace in alignment with the industry's future needs (OECD, 2019_[51]). Other OECD mining regions, such as Western Australian, have developed partnerships with private companies and universities to develop targeted training curriculums for the mining industry's jobs of the future (Box 3.14). Norrbotten and Västerbotten regional councils should strengthen

the collaboration with mining companies and universities to retrain workers in the workplace with digital and cognitive skills and leverage on technological change to involve women in value-added activities.

Box 3.14. Vocational education and training (VET) scheme in Western Australia

With mining automation hitting the coal face of mining in Australia, companies and governments are investing in retaining and updating skills and capacities of the workforce. The company's Pilbara iron ore mines are increasingly dependent on automated drilling, trucks and trains in keeping with an industry-wide trend.

Rio Tinto is investing around AUD 2 million towards the VET initiative to keep up with rapid advances in the mining industry. It will work with the West Australian government and the South Metropolitan Technical and Further Education to establish nationally accredited VET qualifications for school-based traineeships and post-secondary qualifications.

The new curriculum will enhance the capability of those in the mining sector and form part of the learning pathways for those seeking to enter a range of industries applying automation and technology. These courses will likely be in areas including robotics, data analytics and digital inclusion education.

Source: Riotinto (2017^[53]), "Rio Tinto, TAFE and the WA State Government join forces for mining jobs of the future", <https://www.riotinto.com/news/releases/TAFE-WA-Government-partnership>.

Supporting the workforce to re-enter formal education and transition to other occupations can also help to reduce the negative effect of automation in the labour market. The automation of some activities can lead to a greater need for workers to move away from declining occupations. Governments need then to design policies to support workers movement from declining occupations (which are highly intensive in low-skilled routine tasks) to growing ones that have similarities (which are characterised by high-level, non-routine cognitive skills) (OECD, 2019^[51]). To do this, some OECD governments have designed targeted support or individual training accounts (ITAs) for workers to manage disruption in the labour market (Box 3.15). These type of accounts or direct grants allow workers to use available funding at any point in their careers to invest in training – either to help them with career advancement or to adjust to a new job as a result of automation (OECD, 2018^[52]). Identifying the workers at greater risk of job displacement involves comprehensive mapping of sectors and occupations within the local economy that are most susceptible to automation. Västerbotten and Norrbotten should develop, with the input of firms, a map of workers with a higher risk of job automation and develop targeted policies to help these workers re-enter formal education and be able to move to non-routine activities.

Box 3.15. Individual training accounts (ITAs) to retrain labour force

In Scotland, United Kingdom, the government has recently announced the launch of ITAs to make it easier for job seekers and low paid workers to gain access to skill training, giving people up to GBP 200 per year for training and skills development.

In Singapore, the SkillsFuture programme targets skills training at early and mid-career professionals, recognising that technology and globalisation are changing the nature of jobs at a rapid pace. As part of the programme, all Singaporeans aged 25 and above receive an opening credit of SGD 500 to use towards lifelong learning and training. The programme also offers guidance on industry-relevant training programmes that focus on emerging skills such as: i) data analytics; ii) finance; iii) tech-enabled services; iv) digital media; v) cybersecurity; vi) entrepreneurship; vii) advanced manufacturing; and viii) urban solutions.

Source: OECD (2018^[52]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, <https://doi.org/10.1787/9789264305342-en>.

Enhancing regional and international collaboration to consolidate a unified vision on mining

National and international co-operation will pave the path for Upper Norrland to become a model in zero-carbon footprint mining processes and technology. Links with external markets can also improve competitiveness and innovation in the TL2 region, as business collaboration benefits the technological progress of the mining ecosystem and offers new business opportunities for large and small companies. Researchers have found that almost half of new product and process innovations occur through external partnerships (Carlino and Kerr, 2014^[54]). Linking local economy to new markets and knowledge also leads to diversified sources of growth and hence increase the resilience of the economy (OECD, 2019^[46]).

Consolidating a unified vision of mining development between Västerbotten and Norrbotten

Västerbotten and Norrbotten can explore stronger mechanisms to consolidate Upper Norrland as a brand of technological provider for mining. A common view of mining development between the two regions will help unleash business opportunities and pull in investments. This common vision will help to strengthen the co-ordination with the national government and help define the role of mining in the national policy framework (in particular in the regional and mineral strategy).

As presented in Chapter 2, both regions have differences in their economic structures, which provide scope for complementarities in strategic policies. Västerbotten is a more diversified economy with a higher share of the service sector in the economy. These services can be better integrated to support the industrial developments undertaken in Norrbotten mines. The OECD finds that the interaction between the mining and service sectors can lead to positive outcomes in the local economy. For this, a comprehensive map of the backwards and forward linkages of the mining sector across both regions would be useful to identify opportunities to add value in the mining local chain. The research found that, on average, a 10% increase in services used in the production of mining exports is associated with a 2.8%-3.4% increase in mining domestic value-added (Box 3.16). Greater co-ordination to enhance services through mining activities will benefit sustainable development in both regions.

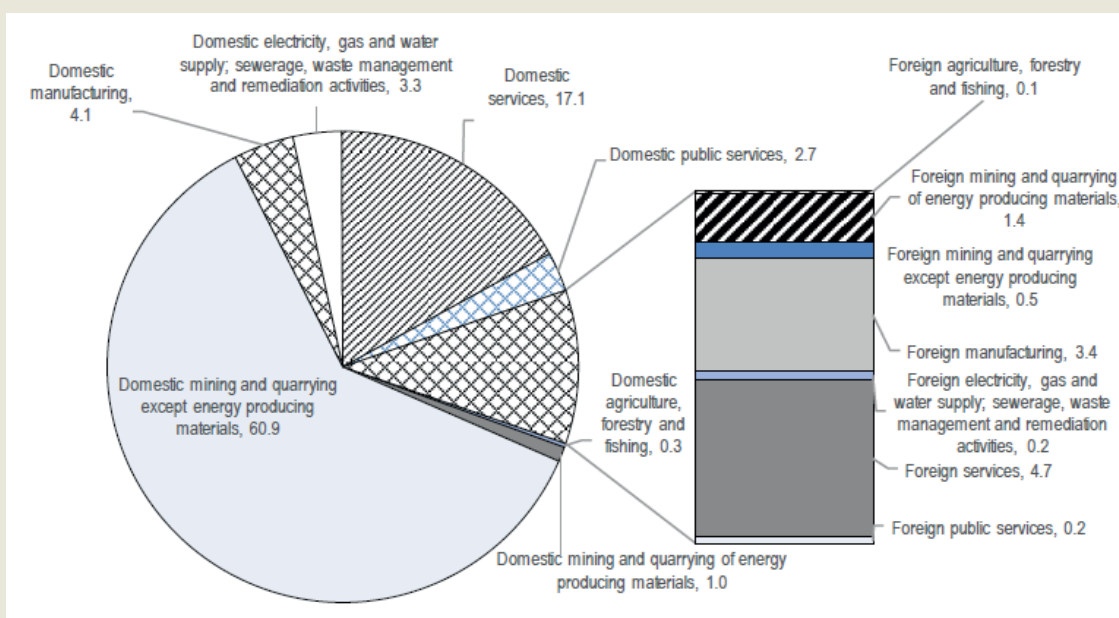
Box 3.16. The relevance of services in the mining value chain

Based on the 2018 Trade in Value Added (TiVA) dataset that comprised 65 countries, the OECD traced value addition into and out of the mining sector throughout the entire value chain. In analyses *backward linkages* refers to upstream sectors that provide inputs to the mining sector. *Forward linkages* refers to downstream sectors that integrate outputs from the mining sector into their production processes.

The analysis found that much of the value-added of mining exports come from the sector itself (59% in 2015). This is due to the inherent value of the minerals extracted, plus the value addition of labour and capital expenditures in the sector. The sector in which mining displays the strongest backward linkages is services, representing 23% of the value-added of exports from the mining sector on average. In Central Asian and European countries, services account for 26% of the value-added of minerals exports. In almost all regions, a large majority of services to the mining sector are produced domestically, accounting for 18% of the value-added of mining exports.

Figure 3.4. Backward linkages, mining sector, 2015

Inputs by sector into mining



Source: OECD Trade in Value Added (TiVA), 2018 release.

The services used by the mining industry vary according to the lifecycle of mines. The mining lifecycle is composed of four main stages: prospection and exploration, feasibility, exploitation, and closure and remediation. Due to the specific legal, technical and economic needs of the mining process, each stage requires specialised mining services. These include geological services such as: surveying and sample analysis; engineering services that contribute to feasibility studies, mining design and oversight of mining operations; construction services for roads, mine sites and mining camps; drilling services at both exploratory and construction phases, among others. Furthermore, mining is increasingly done remotely and digital mining includes services related to data collection and management, specialised software, technologies such as sensing, information gathering through drones and machine learning, and innovative business processes.

Source: Korinek, J. (2020^[55]), "The mining global value chain", <https://doi.org/10.1787/2827283e-en>.

This common vision could be materialised through a clear brand to become internationally visible as an attractive region on mining and environmental technology. A common branding is more than a simple question of labelling; it could be used to shape the vision, projects and stakeholders that can be empowered to join forces and act stronger together (OECD, 2018^[43]). The process of branding also leads to identifying and engaging all relevant stakeholders. Benefitting from an international frontier mining industry, Upper Norrland can shift the perception away from mining as an extractive-only sector towards a branding where the mining sector is seen as a high-tech industry contributing to green technologies.

To operationalise the collaboration among the two regional agendas and the different local actors, the regional councils could agree on a common flagship mining project between both regions. A common project could be materialised in a joint activity that unlocks synergies in a project strategic for both regions, such as the batteries cluster in Västerbotten and the automation mining strategies in Norrbotten. Such a flagship project should trigger value-added across the value chain of both regions. If well co-ordinated, this common project would lead to the strong development of technologies for the zero-carbon mining process and materials. Georange should be the platform where actors from both TL3 regions discuss and agree on common project and vision.

A common project and a single marketing strategy would help both regions to reaching national and European funds in a co-ordinated fashion. This approach coupled with networking activities with other international clusters and global companies would also enhance the chances of attracting international investors.

Co-ordination with other regions in Sweden would also help to build a strong mining network across the country. Norrbotten and Västerbotten have the technology and know-how to support the mining or metal processing industry in other Swedish regions. For instance, a closer collaboration with the mining industry in South Central region can create opportunities for technological and knowledge transfer and new partnerships for local businesses. Various exploration and mining recycling projects throughout Sweden can benefit from the experience of mining-related companies in Upper Norrland. To make the most of this network, the Ministry of Enterprise, Energy and Communications can explore the creation of mechanisms for regional co-ordination on mining activities. It can apply mining partnership schemes inspired by regional association experiences in the Czech Republic and Germany (Box 3.17)

Box 3.17. Mechanisms for regional co-ordination in OECD countries

The **governments of the German *Länder*** co-operate through the Council of Prime Ministers and 19 subject-specific permanent conferences of ministers. The council/standing conferences are not part of the German government and cannot pass legislation. Nevertheless, they play an important role in the federal system. Councils have two primary functions:

- In policy fields where legislative powers reside with the *Länder*, they are the main forum for policy co-ordination across the *Länder*.
- In policy fields where the *Länder* have limited powers, council/conference resolutions articulate common interests of the *Länder* to other actors, such as the federal government or the EC.

Co-operation in the council/conferences is consensus-based. Formally, the Council of Prime Ministers and most other permanent conferences require the approval of 13 of the 16 German *Länder* to pass a resolution. Although resolutions are not legally binding, they have strong symbolic power and are almost always enacted by *Länder* governments.

Some permanent conferences also draft model laws and regulations to support state administrations and further harmonise laws across states. The Council of Prime Ministers convenes four times a year. Subject-specific permanent conferences have their own meetings scheduled and tend to meet between

one and four times a year. Several permanent conferences have established additional committees to discuss particular topics in more detail. The administrative structure of permanent conferences varies depending on their responsibilities. Some permanent conferences have their own permanent secretariats with sizeable staff numbers, while others use the administration of the state that holds the rotating presidency of the permanent conference.

The **Association of Regions of the Czech Republic (AK CR)** was founded in 2001 to represent the collective voice of the Czech regions. It associates the Czech Republic's 13 regions and the capital Prague. The supreme body of the AK CR is the council composed of the president of each region and the mayor of the capital, Prague. The council meets once every six to eight weeks, on a rotating basis in one of the regions.

The association offers services ranging from representing regional interests in parliament, the cabinet and European institutions, to drawing up various reports, standpoints and initiatives. The council elects a chair and three vice-chairs and decides on setting up commissions, which serve as advisors to the council. Current commissions include the Commission for Regional Development, the Commission for Public Administration, the Commission for Education, the Commission for Health Services and the Commission for the Environment and Agriculture. Commission sessions serve for monitoring and issuing position papers/recommendations on major national and European issues in their area of competency. The association has a small secretariat and is financed through membership fees.

Source: OECD (2014^[56]), *Spain: From Administrative Reform to Continuous Improvement*, <http://dx.doi.org/10.1787/9789264210592-en>.

Greater international collaboration to mobilise the regional assets

Collaboration with other countries and in international networks can help Upper Norrland consolidate its new vision and gain visibility as an international provider of green technologies and practices. Upper Norrland's transition towards a high technological and expertise hub for environmentally sustainable mining and minerals value chains is very much in line with the efforts undertaken by various EU networks and countries and plays a key role in the collaboration with the Arctic agenda.

The EU has a number of co-operation programmes promoting collaboration among mining and metallurgy regions across Europe. These programmes have promoting the EU critical materials initiative as a central agenda, aiming to attain a sustainable supply of mineral raw materials for European countries. These programmes include:

- The Smart and Green Mining Regions (REMIX) project, a network that links EU mineral-rich resource regions to support innovations of large- and small-scale companies in their regional mining value chains.
- The Mining and Metallurgy Regions of EU (MIREU) project, a network of mining regions aiming to develop guidelines and recommendations for the sustainable supply of mineral raw materials to the EU.
- The European Institute of Innovation and Technology (EIT) RawMaterials initiative. Funded by the EIT, this initiative aims to enable the sustainable competitiveness of the European minerals, metals and materials sector along the value chain by driving innovation, education and entrepreneurship.

Upper Norrland needs to enhance its participation in the available networks to strengthen its position as a technology provider of carbon-free materials and minerals. Norrbotten hosts one of the hubs of the EIT RawMaterials innovation programme. Innovation hubs support this initiative by setting up knowledge and innovation community activities, triggering the emergence of new ideas and innovations and ensuring that infrastructures are shared amongst partners. Region Västerbotten is a member of the MIREU network. However, despite being an important player in the EU mining ecosystem, Norrbotten has been little

involved in EU MIREU and REMIX networks. TL3 regions should take a more active role in EU mining networks in order to benefit from knowledge exchange and lead projects on environmentally sustainable mining.

Furthermore, there exists a number of initiatives trying to unleash synergies among countries in the Arctic and Baltic Sea area. The Arctic is a fragile environment with unique species that play a key role in the regulation of the world's climate and hosts an important diversity of natural resources. This factor has led to an increasing geopolitical interest in the Arctic. The Arctic Council is an intergovernmental forum that promotes co-operation among the Arctic states and stakeholders to address issues of sustainable development. The members of the Arctic Council include Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden and the United States. Non-profit organisations, such as the Arctic Circle, also promote international dialogue and co-operation on the future of the Arctic through international assemblies and fora.

Furthermore, a higher level of co-operation and knowledge exchange with Arctic regions can address shared development challenges and unlock business opportunities. Regions in the Arctic share similar characteristics. Common assets include the internationally strategic location coupled with a cold climate and large geographical extension, with common challenges on depopulation, ageing and environmental vulnerability. Upper Norrland regional councils should promote exchanges of workforce and practice sharing to deal with ageing and outmigration. Furthermore, as other Arctic regions are located in the same geological bedrock – including Lapland (Finland) and Nordland and Troms (Norway) – developing common mining projects will help to build scale, pool knowledge and resources to strengthen a green and technology-driven mining ecosystem in this part of the world. To benefit from those opportunities, the regions in Upper Norrland should enhance their participation in co-operation activities with Arctic and Baltic countries.

The co-ordination with other Arctic regions and European mining networks needs to promote the benefits of environmentally sustainable mining to support the global environmental agenda. To this end, Upper Norrland needs to co-ordinate awareness campaigns and knowledge exchange with EU official and other mining and environmental actors on the positive effects of carbon-free value chains to support the EU green deal and the EU agenda of the zero-carbon energy transition. This also involves creating the scenario to support the development of EU standards on the use of carbon-free minerals and materials (Chapter 4). Strengthening the environmental lens in the market of minerals can level the field with international mining products and move forward the EU agenda of self-sufficiency on critical minerals. The aftermath of the COVID-19 pandemic offers a fertile ground to discuss self-sufficiency and the relevance of supporting high-quality environmental in goods.

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Notes

¹ The Investment Attractiveness Index is a composite index that combines both the Policy Perception Index (PPI) and results from the Best Practices Mineral Potential Index, which ranks the jurisdictions based on whether region's geology "encourages exploration investment" or is "not a deterrent to exploration investment".

² Regional impact analyses typically distinguish direct effects, including increased income, output and employment, in the sector under scrutiny and indirect or multiplier effects, which embody the effects of changes in demand for various goods and services caused by the initial change in economic activity in one sector (Ejdemo and Söderholm, 2011^[20]).

4

Setting the right frameworks for sustainable mine development in Upper Norrland

This chapter makes recommendations on regulatory and land use planning frameworks around mining and regional development in Upper Norrland. It starts with an overview of the regulatory framework for mining permits and identifies ways to avoid delays, improve predictability and enhance transparency to the benefit of all parties involved, including the private sector, regional and local governments, affected communities and Sami people. Further, it outlines how engagement around mine development can be improved and, lastly, it investigates how land use is managed and points to the importance of linking special planning with regional development objectives such as mining.

Assessment and recommendations

Assessment

- **Sweden has a complex and multi-layered regulatory framework that can improve efficiency, predictability and transparency.** Key challenges to overcome include delays resulting from late appeals or uncertainty on the scope of permit applications, limited trust and perceived legitimacy, as well as separate decision-making on land use and other environmental factors. Changes to the system are needed to increase attractiveness for investors, resolve planning bottlenecks for municipalities and avoid tensions between interest groups.
 - Several steps, various laws and different agencies involved in the permitting process, in combination with limited guidelines and lack of clarity on assessment criteria create a complex permitting process. This complexity makes it difficult for companies to anticipate the views and requirements of government agencies, extends timeframes and disadvantages small mining companies and investors, which cannot draw on the same resources as large, established companies to manage these processes. In some municipalities, delays create significant uncertainty in relation to land use planning and investments (infrastructure, services and houses).
 - The two major agencies that can take decisions on mines, namely the Mining Inspectorate and the Environmental Court, operate under different objectives and permitting stages. This segmentation means that mining concessions are given before the impact of the whole project is assessed and environmental impacts considered. Also, decision-making is not comprehensive with regard to social, economic and cultural aspects as well as cumulative effects happening on a certain territory. Including these in the process is essential to shift towards requiring a positive contribution to sustainable regional development from mining and away from only mitigating adverse effects.
 - The current system provides limited direction in terms of guidance or legal requirements on how to conduct meaningful consultation of local and regional perspectives on mine development, including from Sami people. This reduces local support for mining activities and decreases the ability for companies to identify critical issues early and better adopt a project proposal to the local environment and social context. From an international law perspective, reindeer herders are also rights holders as well as being stakeholders; however, free, prior and informed consent is not required in Sweden. Further, the prioritisation of national interests falls under the responsibility of the County Administrative Boards (CABs) – a national agency – that operate at great discretion resulting in different boards applying different standards across places.
- **In Västerbotten and Norrbotten, there is a need to better link regional development objectives with land use.** The expansion or introduction of extractive industries generates new land use and infrastructure requirements that need to be incorporated into municipal planning. Decisions are often largely based on compliance with national guidelines (such as areas of national interest). Also, they often lack consideration from a regional development perspective and are limited in their flexibility to respond to rapidly arising needs. Similarly, regional development programmes miss a physical planning perspective, in order to deliver on regional development objectives in both counties.

Recommendations

Improve Sweden's regulatory framework to better reflect regional development opportunities. For this the national government should:

- **Adopt instruments to improve predictability.** For instance, by introducing set timelines and limits for decision-making at the onset of an application process. Outlining intermediate steps and windows for feedback/dialogue can provide project proponents with more clarity on when determinations are made and ensure that public consultations are planned with sufficient lead time. This should go hand in hand with strengthening possibilities for all local actors to have the possibility to participate in the process. Alternatively, a performance indicator for government agencies that publicly reports on statutory timeframes could be an option.
- **Strengthening the evidence base, which underpins decision-making for mining concessions and environmental permits through better definition of the extent to which socio-economic, cultural and cumulative impacts are considered in decision-making.** To this end, detailed definitions in the legislative language of the Environmental Code and other provisions should be developed to clearly communicate scope and interpretation of socio-economic and cultural impacts. How impacts are considered and weighted in decision-making should also be defined. Further, concrete guidance for project proponents on how to best assess these impacts for applications should be developed. Explanations of cumulative impacts should account for spatial and temporal scale impacts as well as interrelationships between impacts. Cumulative impact assessments should further include a contribution to regional development objectives. Decision-making can be facilitated through making use of context-specific sustainability-based criteria and trade-off rules.

Increase the legitimacy and transparency of the permitting processes through the more developed and inclusive mechanism of dialogue and consultation with all local actors, including Sami people. For this, the national government should:

- **Develop clear and consistent consultation guidelines for the mining industry.** It should define how the consultation process should proceed and who should be involved in the process, including parameters around what type of information is provided to communities at each step of the process. It should also clarify to what extent project proponents and responsible authorities ought to take voiced perspectives and positions into account. The Swedish government should consider introducing an impartial oversight of the process through a dedicated body, agency or person. Specific guidelines for consulting with Sami villages should be developed together with the Sami Parliament and other Sami stakeholders. These should also define the status of Sami traditional knowledge in the consultation.
- **Ensure early-stage engagement and consultation rules within the framework of the Minerals Act and Environmental Code.** This should include how and when notifications should proceed and the nature of the engagement (format, etc.) as well as required documentation.
- **Strengthen the capacity of rights holders and interested parties for engagement, including Sami villages.** This should entail that proponents need to provide financial resources to affected parties to compensate for the cost incurred in corporate consultation without any obligation influencing the outcome, further, providing greater overall institutional and analytical capacity to special interest holders to manage demands for consultation. For affected Sami people, the Sami Parliament could play a stronger co-ordinating role in distributing information to Sami villages with regards to making contributions in consultations, conducting consultations and making agreements with mining companies. For instance, it could establish a panel of

experts/lawyers that Sami villages can draw upon at no or reduced cost. It could also include establishing a register of agreements between mining and energy companies and Sami villages, and templates/guidance to support agreement making. This can improve transparency in the process and encourage peer learning amongst communities that need to deal with similar requests.

Better link regional development with land use and resources planning. The regional councils should:

- **Create an effective co-ordination framework that allows for strategic dialogue about land use and economic development between municipalities and regional councils.** Planning based on potentials and opportunities can be incentivised by developing strategic spatial plans at a regional scale. The region of Skåne offers a good example that could guide this process. Regional spatial plans should account for interrelationships at functional scale and can help guide regional and municipal planning. It should also be used to guide decisions made on regional development policies and cumulative impacts through informing the platform for resource development.
- **Develop a platform for resource development to facilitate regional, sustainability-based planning for mines and resource projects.** The platform would oversee all mining and ideally other infrastructure and energy applications in the region, compile information on land use and act as a contact point for all stakeholders, including authorities, proponents for mining projects and landowners, interest holders and the general public. It could help to reduce the frictions of multiple reviews and entities, ensure the neutrality of consultation processes and improve decision-making on developments. Its role should include setting up a geospatial database displaying all current permit processes as well as current land use activities. This information should be used to keep track of cumulative impacts and should provide guidance for governance agencies on decisions to be made in permit applications.

Introduction

Institutions, regulatory frameworks and planning processes create important framework conditions for regional development. Fostering the growth of the regional mining industry may require new transport and housing developments, as well as the protection of environmental assets and amenities. This can also impact the capacity to develop other areas such as tourism and recreation. Regulatory processes and planning frameworks define how policy objectives are turned into reality. They balance different interests, assess risks and benefits of potential developments, define who is involved in decision-making processes and plan for how available space is used. In the mining context, regulations and institutional frameworks also play a key aspect in the countries' attractiveness to new developments and in assuring local social acceptance of mining, for instance, through high levels of transparency and legitimacy.

Changing global and local circumstances, such as demographic change, automation and transition to a low carbon economy, can challenge systems in place and create the need for adjustments both in formal regulations but also in informal roles and ways of working. The previous two chapters have underlined the challenges and strengths to be addressed by the regions of Västerbotten and Norrbotten. They highlight the need to address the consequences of a rapidly ageing and declining population and the potential of becoming a global leader in environmentally sustainable mining practices through innovation and building a strong ecosystem for local businesses.

Responding to these challenges will require regulatory and planning processes to reflect objectives and vision for growth outlined by national and regional policies. They contribute to assuring future attractiveness for investors, sustaining a collaborative approach between different levels of government, businesses and Sami communities, and help regions and municipalities designate the needed land for a variety of activities.

This chapter offers assessment and recommendations on regulatory and planning structures that are important for regional development in the mining context in Sweden. This includes regulatory framework and planning guiding mining and mineral activities in Sweden and the distribution of competencies in regional policymaking and its implementation. It starts by examining bottlenecks in the regulatory process for mining permits and looks at ways to avoid delays and improve predictability, transparency and legitimacy for all involved parties, including the private sector, regional and local governments, and affected communities, including the Sami. Further, it outlines how engagement in the mining permitting process can be improved and, lastly, investigates how Västerbotten and Norrbotten govern their multifunctional geographical landscapes in the context of mine development and points to the importance of linking special planning with regional development objectives as well as greater collaboration amongst local and regional constituencies.

Improving the regulatory formwork to better reflect regional development opportunities

Laws and regulations govern the everyday life of businesses and citizens and are important tools of public policy. Laws and regulations help to protect consumers, workers, the environment and the like. Yet, they are also an area where striking a balance between too much and too little is key. The OECD work on regulatory policy has pointed out that good regulation is conducive to economic growth and well-being, and inadequate regulation endangers both. Too limited, poorly conceived or incoherent rules can create significant hurdles for starting businesses, trading or complying with basic administrative procedures (OECD, 2018^[1]).

In a changing world, where countries and regions need to adjust to megatrends like digitalisation and automation, the regulatory policy can be an important tool to systematically manage risks and benefits. For instance, as technologies offer potential economic rewards and improving environmental outcomes in mining, they can also hold a risk such as reduced local labour force participation. Hence, managing the social, employment and other impacts of the digital economy demands sound regulatory policies that account for them.

Key issues for regulatory frameworks are lack of transparency in rule-making and inefficient or improper enforcement. Further, uneven regulations can lead to losses in organisational performance and administrative discretionary power to make decisions. In cases where rules fail to protect, this can lead to a loss of trust in institutions and even in government itself. More meaningful engagement, greater transparency and better communication are needed to ensure that citizens and businesses feel included in the policymaking process, accept regulatory decisions and, ultimately, trust their government (OECD, 2018^[11]).

This section focusses on the Swedish regulatory system for mining permits and how this affects regional development opportunities in Norrbotten and Västerbotten. It presents the relevance of a well-functioning system to regional development and elaborates on crucial bottlenecks within the system. These include predictability, transparency and trust in the systems as well as co-ordination between different government authorities and capacities of decision-makers (Pettersson et al., 2015^[2]; Hojem, 2015^[3]; SveMin, 2012^[4]). This section offers suggestions on how to better structure the Swedish regulatory process to unlock opportunities for regional development linked to mining and extractive industries, highlighting how other countries attempt to address similar challenges.

Importance of a predictable and transparent regulatory system for regional development

Mining is of great significance to the supply of resources and wealth but also contains environmental, social and cultural impacts that are sensitive and need to be evaluated and managed carefully. How governments regulate the mining sector shapes its environmental impact, its attractiveness to investors and its acceptability to local communities. The mining regulatory framework is pivotal to ensuring different interests are protected. This is of particular importance for regional development as impacts of mining and extractive industries are often highly localised. Local impacts range from environmental aspects to questions of land use, employment opportunities and pressures on housing and public services.

Regulatory systems that are unpredictable, inefficient, lengthy and opaque can fail to balance opportunities and challenges. This reduces attractiveness for investors, causes planning bottlenecks for municipalities and can result in the polarisation of communities. Recent studies show that public policy is a key factor in determining investment decisions. Respondents to the 2017 Fraser Survey of Mining Companies indicated that, on average, public policy makes up 40% of their investment decision. This is almost as much as geology (Stedman and Green, 2017^[5]). Particularly, small junior exploration companies struggle when it comes to uncertainties in regulatory environments, as their access to capital is often limited. The cyclical nature of the minerals markets with fluctuating prices further reduces investment timelines and increase the need for regulatory stability (Söderholm et al., 2015^[6]).

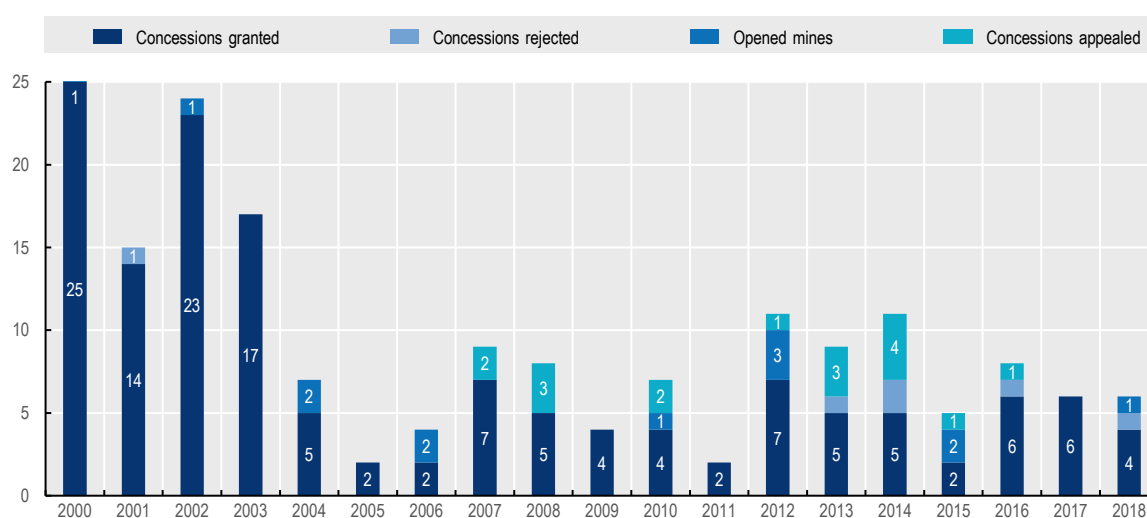
The predictability and certainty of decisions made are also crucial for municipal planning and social cohesion. Regional governments, including municipalities, often see mining as an opportunity to foster regional development through increased employment and tax revenues as well as the development of local infrastructure and services. This, however, needs significant lead time as comprehensive plans that set out a long-term view on how land should be used need to be developed. If decisions on the use of land and water remain undefined, no development of industrial or residential areas can go ahead. Also, significant time is needed to set up programmes that allow the local workforce to be trained and upskilled and enable them to participate in newly created jobs. In municipalities that are specifically dependent on mining, uncertainty about future developments can severely hamper municipal planning processes.

Further, institutional conditions, as well as trust in regulatory agencies, can influence the perception of benefits and risks of mining in local communities (Walsh, van der Plank and Behrens, 2017^[7]). In many cases, mining has caused tensions within communities affected by possible mine operations due to negative local socio-environmental impacts that are not being compensated for. Especially in Europe, public acceptance, awareness and trust in the mining industry is lower than anywhere else in the world and improved acceptance is considered crucial for future success (Zachrisson and Beland Lindahl, 2019^[8]). In this context, strong public engagement and consultation mechanisms are crucial to avoid polarisation of communities and disturbance of social climate.

The status quo: Declining numbers of exploration permits and exploitation concessions and an increasing number of appeals

The number of valid exploration permits for mining as well as the granted exploitation concessions has declined since 2000 (Swedish Geological Survey, 2018^[9]; 2018^[10]) (Figure 4.1). The number of valid exploration permits in Sweden has gone from approximately 1 300 in 2008 to approximately 600 today. The majority of these exploration permits (359) can be found in the counties of Norrbotten and Västerbotten. In 2018, 152 exploration permits were granted and 86 extended, and 50% (76) of the granted and 80% (68) of the extended permits are to be found in Norrbotten and Västerbotten. Sweden's large mining companies Boliden and LKAB together account for 64% of exploration efforts in the country. The majority of the 2018 exploration was made up of mining exploration, meaning exploration near an existing mine.

Figure 4.1. Approved, rejected and appealed exploitation concessions, 2000-18



Note: For 2017 and 2018 no data on appeals were available.

Source: Swedish Geological Survey (2018^[9]), *Bergverksstatistik 2018 - Statistics of the Swedish Mining Industry 2018*; Rolmer, S. (2018^[11]), "Is Sweden becoming a high-risk jurisdiction for exploration and mining?", <https://www.linkedin.com/pulse/sweden-becoming-high-risk-jurisdiction-exploration-mining-r%C3%B8lmer> (accessed on 20 December 2019).

A rule of thumb is that around 1 in a 1 000 exploration permits lead to the opening of a mine. Out of all valid exploration permits in Sweden over the past 10 years, just 50 have been granted approval as exploitation concessions. Since 2008, the Mining Inspectorate rejected five applications for exploitation concessions and seven mines were opened (Figure 4.1). Most of the applications for exploitation concessions are extensions of older existing mines (Swedish Geological Survey, 2018^[9]). Table 4.1 also demonstrates that the number of appeals seems to have become more frequent since 2007. This suggests

that the concession process has become lengthier and more unpredictable. This is important as it reduces investor's interests and can lead to the significant unclarity of potentials for regional development within regions and municipalities.

In Sweden, the application for an environmental permit is often one of the most time-consuming parts of the permitting process. This is largely dependent on the nature of the operations. Yet, the vast majority of permits in the past decade have been extensions of existing operations or restarts of previously abandoned mines. Environmental permits for temporary or time-limited increases in production in existing operations tend to have shorter lead times while cases concerning new mines tend to have longer lead times (OECD, 2019_[12]).

The status quo: A complex multi-layered framework comprised of three essential permitting steps

In Sweden, the legal basis for exploration and exploitation is complex and involves a multitude of authorities and different laws and regulations in order to ensure different perspectives are considered. The different regulations and responsible authorities are applicable in parallel and summarised in Table 4.1. The key legislative framework governing mining permissions is the Minerals Act. It covers specially designated valuable mineral substances, known as concession minerals.¹ The purpose of the act is to ensure the supply of important mineral sand metals. Thereby it is largely focused on assessing the economic value of a potential mine site. The Environmental Code provides an environmental assessment aiming to protect the environment and ensure a healthy and sustainable living environment for present and future generations. In addition to that, other laws can also apply (see Table 4.1).

Table 4.1. Main mining regulatory instruments in Sweden

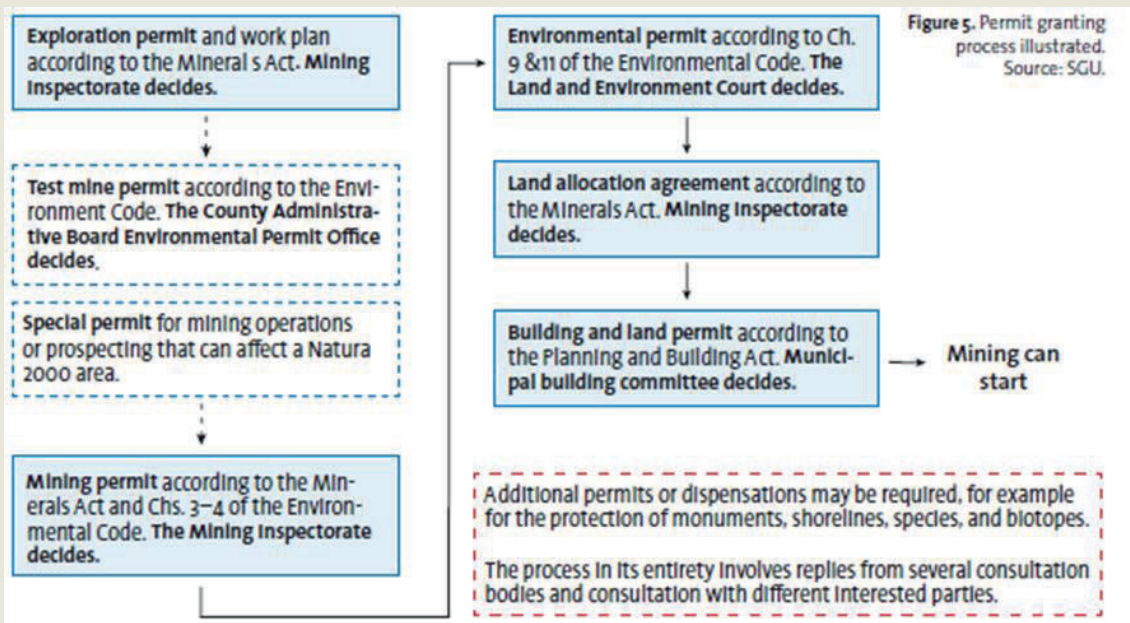
Instrument	Instrument in Sweden	Responsible authority
Laws specific to mining	<ul style="list-style-type: none"> Minerals Act (1991:45). The act is applicable to the exploration and exploitation of the land. 	<ul style="list-style-type: none"> Mining Inspectorate of Sweden, which is part of the Geological Survey of Sweden (SGU)
Other laws	<ul style="list-style-type: none"> Environmental Code (1998:808). The code is applicable to all those activities that could potentially be detrimental to human health or the environment, damage the natural or cultural environment or deplete biological diversity. It defines areas of national interest relating to the natural environment. 	<ul style="list-style-type: none"> Swedish Environmental Protection Agency Land and Environmental Court County Administration Boards
	<ul style="list-style-type: none"> Planning and Building Act (2010: 900). The act contains a provision on the planning of land and water resources and buildings. Part of this is a comprehensive plan developed by each municipality that specifies long-term development options for the physical environment. 	<ul style="list-style-type: none"> Municipalities National Board of Housing, Building and Planning
	<ul style="list-style-type: none"> National implementation of UNESCO World Heritage Convention. Defines areas of national interest for cultural environment. 	<ul style="list-style-type: none"> National Heritage Board
	<ul style="list-style-type: none"> Reindeer Husbandry Act. Defines areas of national interest for reindeer husbandry. 	<ul style="list-style-type: none"> Sami Parliament
	<ul style="list-style-type: none"> EU Habitat Directive and national implementation of Natura 2000. 	<ul style="list-style-type: none"> Swedish Environmental Protection Agency County Administrative Boards
	<ul style="list-style-type: none"> Off-road Driving Act (1975). 	<ul style="list-style-type: none"> Municipalities County Administrative Board Swedish Environmental Protection Agency

Source: OECD Questionnaire, 2019; Government Offices of Sweden (2012_[13]).

Overall, these laws are applied in a permitting process which is made up of the following three steps before a mining operation can start (a simplified illustration of the process can be found in Box 4.1):

- An **exploration permit** (*undersökningstillstånd*) gives access to the land and an exclusive right to explore within the permit area. It does not entitle the holder to undertake exploration work in contravention of any environmental regulations that apply to the area. Thus, no actual exploration work can be carried out without a valid plan for operations. Formal consultation is mandatory in an application for an exploitation concession. The plan for operations needs to be presented by the permit holder to the landowner or holder of special rights. It includes a detailed map, information on how objections can be made, an assessment of the damage to be expected and how the damage will be addressed, and the form and amount of security provided by the permit holder for this. The *samebyar*² are considered holders of such special rights in the Minerals Act. Landowners or reindeer husbandry communities can object to the plan of operations. If the permit holder does not change the plan of operations according to the objections, the landowners or the *sameby* can request that the Chief Mining Inspector settle the plan. The Chief Mining Inspector can then add restrictions to the plan of operation to safeguard ongoing activities in the area, for example. The plan should also be shared with the municipality, the CAB and Sami Parliament if the area is used for reindeer herding.
- An **exploitation concession/mining permit** gives the holder of the permit right to the minerals covered by the permit for up to 25 years and clarifies land use issues. However, the permit does not allow any mining operations to commence, as this requires an environmental permit. During the mining permit, the consultation process with landowners and *sameby* is the same. Since, 2017, consultations are required to include the general public and authorities. Consultations are announced to the public via the Mining Inspectorate, allowing for a minimum of 30 days for comments. The information given should cover the planned location for the mine; it is seized, design and form as well as expected environmental impacts. According to the Environmental Code, an environmental impact assessment (EIA) must be conducted. However, this is limited in content and focuses more explicitly on land use, whereas a larger EIA is to be conducted at a later date, as a part of the environmental permitting phase. In many cases, for instance areas of national interest for mineral resources, recreation and reindeer herding overlap. At this stage, it is the Mining Inspectorate that is responsible for taking the decision and balancing it with other interests, which are represented by the CABs as representatives of the state. The CAB often consults with municipalities and other government agencies on matters of land use. If the Mining Inspectorate and the CAB disagree, the government decides on the matter. When an application for an exploitation permit is examined, the entire scale of the mining operation is not yet known. The design of the mining plant is not final at this stage and it is thus impossible to assess the full impact of planned operations on the activities and environment outside the area covered by the exploitation permit. This is considered in the next stage, the environmental permit process.
- The application for an **environmental permit** is based on a case-to-case assessment. It sets the conditions under which the mine may operate. At this stage, the final design of the mining operation is decided and the full impact on the activities and environment outside the mining plant is evaluated and regulated. A permit will define the conditions for the design, building, operation and closure of a mining installation. Such an application shall be supported by a comprehensive EIA, in which formal consultations with stakeholders will be carried out under the conditions described above. The assessment and resulting regulations are mainly based on the conditions outlined in the Environmental Code. The authority that grants environmental permits is the Land and Environmental Court (Pettersson et al., 2015^[2]; Hojem, 2015^[3]; OECD, 2019^[12]).

Box 4.1. Simplified illustration of the permitting process in Sweden



Source: MineFacts (2020^[14]), *A Collection of Facts about Mine*.

Avoiding delays and assuring predictability

Delays in the permitting process are a concern for companies and governments because they reduce project value and incentives for investment. They are often linked to insufficient staffing, imprecise timelines for governments to respond, vague guidelines for the assessment of cases or unclear specification of lead agencies (Söderholm et al., 2015^[6]; SNL Metals & Mining, 2016^[15]). The least frequent delays are typically found in developed mining countries, including Sweden. With regards to granting exploration concessions, Sweden was ranked 12th out of 23 in terms of being able to receive necessary permits within 6 months. This middle ground position puts Sweden ahead of several countries, including Australia and Finland. Overall, the study found that 36% of Swedish respondents indicated that they received their exploration permits in 2 months or less and 27% reported receiving them in 3-6 months; only 9% stated that it took 19 months or more to receive a permit. Also, 55% of responses indicated that time to permit approval had either lengthened somewhat or considerably (Stedman and Green, 2018^[16]). While data on exploitation permits is not currently available, it does not seem that the overall permitting process in Sweden takes considerably longer than in other countries. Still, there are possibilities for improvement.

In the past, Sweden has increased staff in the relevant authorities to reduce delays in permitting processes (Söderholm et al., 2015^[6]). Timeliness, however, is not only linked to available resources in authorities. Predictability of regulations and interpretation of legal rules also play an important role in the process. Qualitative research suggests that companies indicate frustration about additional requirements and unpredictable authority intervention that generate uncertainty and delays (Beland Lindahl et al., 2018^[17]).

The aforementioned increase in appeals suggests that the Swedish legislation might offer vague assessment guidelines, which create opportunities for late appeals, which further extend timeframes. Amongst many, two cases can serve as examples in this regard:

- First, the case of LKAB in the community of Svappavaara. The initial decision of the Environmental Court was successfully appealed by the Environmental Protection Agency on the grounds that the new operations had to be judged in conjunction with existing (refining) facilities. This resulted in a new application to be prepared and granted after 3 years (Söderholm et al., 2015^[6]; Pettersson et al., 2015^[2]).
- Second, the Kallak North mine near Jokkmokk where the mining company Beowulf has been seeking an exploitation concession since 2013. The case exchanged multiple times between different government agencies because of unclarity regarding the impact on the world heritage area Laponia and unresolved Sami rights. As the Swedish Mining Inspectorate and the CAB of Norrbotten have not reached a common conclusion, the case is now with the Swedish government for decision. In February 2020, the mining company Beowulf considered suing the Swedish state for project delays and lack of information on future action (svt Nyheter, 2020^[18]).³

In both cases, it was difficult for companies to anticipate the views and verdicts of government agencies, creating uncertainty about the extent of the required assessment. This is because, first, the legal text and case law provides limited guidelines on the scope of the permit application, in terms of geographical limits and the relation to existing activities in the case of environmental law for instance; second, governmental agencies do not seem to be clear on each other's assessment criteria.

In Finland, the scope of environmental permit applications is more clearly defined, as cases are not judged on the specific location and the particular concerns of expert authorities over a particular issue, but make use of predetermined standards for certain aspects such as noise. On the upside, this adds predictability for applications, yet it can also lead to unreasonable outcomes in individual cases (Söderholm et al., 2015^[6]). Overall, introducing more standardised procedures and road maps for economic impact assessments (EIAs) and permits could improve the process in terms of timeliness and predictability. This is because it would allow for addressing potential issues as well as solutions at an early stage in the process.

Other countries have decided to use predefined time limits in which decisions have to be made to improve processes. Canada, for instance, sets out roles and responsibilities for each agency together with timeline-based targets, which are published at the start of the application process. This ensures that all parties involved have a predictable time schedule. The only time periods not defined are those for submission by the mining company itself; any delays in the permitting process are more likely to be the responsibility of the mining company rather than the federal agency. This way, intermediate steps of the decision-making process are clear and all involved parties know when feedback can be provided before determinations are made. This can also avoid appeals at a later stage and make sure that public consultation with stakeholders is conducted as early as possible.

Yet, tightening processes and increasing predictability should not come at the expense of public consultation or stringent environmental assessments. It is well known that it takes a certain amount of time to establish good relations with local stakeholders to address their concerns. Further, stringent environmental regulations should not be equated with an unattractive mining investment climate. In fact, jurisdictions with some of the most stringent environmental regulations are ranked amongst the most attractive in terms of the policy environment for mining (Stedman and Green, 2018^[19]).

An example of processes from Canada is outlined in Table 4.2. In order for time limits to be successful, they are likely to require increased resources as authorities have to make sure that applications are complete and make a decision of commencement of the timeline (Pettersson et al., 2015^[2]). In cases where there are timelines but that are regularly extended or seldom adhered to, an alternative process would be to develop a performance indicator for government agencies that publicly reports on statutory timeframes.

Table 4.2. Key milestones for the environment assessment, Canada

Milestone for Hardrock Deposit (Gold)	Lead	Timeline/Completion date
NoC on CEARIS	CEA Agency	13 June 2014
Public and Aboriginal group comment period on the draft EIS guidelines	CEA Agency	13 June 2014 – 13 June 2014
Finalise the EIS guidelines and provide to the proponent	CEA Agency	14 July 2014 – 5 August 2014
Submit the EIS and EIS summary	Proponent	To be determined by the proponent
Perform conformity check of the EIS	CEA Agency	Day 45-51 (7 days)
Public and Aboriginal group comment period on the EIS summary	CEA Agency	Starting between Day 52 and 76 (for a duration of 30 days)
Review and provide comments on the EIS to the CEA	Fas	Day 52-91 (40 days)
Review and provide information requests on the EIS to the proponent	CEA Agency	Day 52-109 (57 days)
Submit a response to information requests	Proponent	To be determined by the proponent
Review and provide comments on the additional information to the CEA	Fas	Day 110-139 (30 days)
Review and provide information requests on the additional information to the proponent	CEA Agency	Day 110-144 (35 days)
Prepare the draft EAR	CEA Agency	Day 145-225 (81 days)
Public and Aboriginal group comment period on the draft EAR	CEA Agency	Day 226-255 (30 days)
Review and provide comments on the draft EAR to the CEA	Fas	Day 226-260 (35 days)
Finalise the EAR and submit to the minister	CEA Agency	Day 261-335 (75 days)
Minister makes environmental assessment (EA) decision	Minister	Day 336-365 (30 days)
Issue and post the minister's EA decision statement on the CEARIS	CEA Agency	Day 365 (0 days)

Note: CEA: Canadian Environmental Assessment Agency; CEARIS: Canadian Environmental Assessment Registry Internet Site; EAR: Environmental assessment review; EIS: Environmental Impact Statement; FA: Federal authorities; NoC: Notice of commencement; Source: SNL Metals & Mining (2016^[15]), *Permitting, Economic Value and Mining in the United States*, <http://www.SNLmetals.com> (accessed on 11 February 2020).

Improving trust and legitimacy in the permitting process

Increasing effectiveness alone will not be sufficient to improve bottlenecks in the permitting process. Equally important is the local support for mining and extractive activities. One way to assure this is by designing permitting processes and regulatory frameworks that are perceived as legitimate and trustworthy by all actors, including those that might disagree with a mining venture. Research on the social licence to operate suggests that procedural fairness is a significant positive predictor of trust towards mining companies. Community members who perceive they are feeling heard, listened to and that their concerns are reflected in action show increased acceptance of mining operations (Moffat and Zhang, 2014^[20]). Options to achieve this include offering strong possibilities for all local actors and other stakeholders to participate in mining policymaking and permitting and setting up more developed – and inclusive – mechanisms for dialogue and consultation.

The energy transition needed to a zero-carbon economy and increasing interest in the industry to source minerals and materials from more sustainable sources offers the potential to increase mineral exploration in Sweden. The spatial concentration of mining in Sweden can result in uneven distribution of benefits and negative externalities of mining activities. This creates significant opposition to mining if local actors do not feel they benefit from development or their voices are sufficiently taken into account in decision-making processes. Research shows that resistance to mining ventures increases when there is limited or no

possibility of mining-sceptical actors to influence either policy formulation or their implementation, i.e. actual licensing processes (Zachrisson and Beland Lindahl, 2019^[8]).

In Sweden, opposition to mining has increased in recent years (Zachrisson and Beland Lindahl, 2019^[8]). Main concerns evolve around the socio-environmental impacts of mining on land, water and livelihoods, a demand to increased recycling as well as the demand to recognise Indigenous peoples' rights in the licensing process. Local actors comprise a broad range of interests that are sceptical of mining. These are represented by environmental and social non-governmental organisations (NGOs) (e.g. action, environmental, outdoors and recreation organisations), Sami reindeer-herding communities, other Sami organisations, villages and community associations as well as political parties in municipality councils. While large established companies might know the context and generally have good local connections that allow them to deal with opposing parties, junior companies take greater risks in entering conflict-laden situations and are likely to be deterred from entering the region.

A key problem in the conflicts is that the institutional framework regulating permitting processes is not seen as fair or trustworthy by actors that do not share a proposed development pathway. This is because they perceive the process as dominated by national and mining actors, offering insufficient opportunities for involvement through formal channels. As a consequence, these actors seek to find ways to intervene, for instance through public protest or appeals to make their voices heard. This causes major delays, makes processes more expensive and adds to frustrations in local communities (Zachrisson and Beland Lindahl, 2019^[8]; Beland Lindahl et al., 2018^[17]; 2016^[21]).

This means that increasing the legitimacy of the permitting process is essential for Upper Norrland to improve prospects from regional development from mining. Regional and national policymakers have a significant responsibility to clarify which rules apply, act as mediators to advance processes and foster reconciliation between groups. This section presents several tools to help enhance legitimacy, including better and enlarged consultation practices as well as neutral and highly skilled decision-makers.

Overall, the entire process offers three entry points for rights holders or interested parties for each step of the permitting process (see Box 4.1) and two entry points for the general public as part of the mining concession and environmental permitting phase. In each case, information about the project is made public by the Mining Inspectorate, which offers a minimum period of 30 days to comment and object to the provided information.

The fact that since 2017 consultations were made obligatory with regards to the entire public has resulted in a reduction of protests and improved the situation in Sweden (Zachrisson and Beland Lindahl, 2019^[8]). This is partly because consultation now starts earlier: before consultation was only required in the environmental assessment, the last step of the permitting process. Further, research suggests that access to information and consultation is particularly beneficial with regards to actors that display rather moderate objections and have pragmatic viewpoints. Still, overall, actors feel like they are too few instances for entering the process and the quality of consultation is inadequate (Beland Lindahl et al., 2016^[21]).

Critical points revolve around the fact that the process differentiates between special rights holders and the general public, because rights holders are given more information, have the right to appeal and are more likely to be invited to participate in consultations. Further, there are limited opportunities for regional development perspectives to be included in the decision-making. This is largely because a critical point in the process – the preparation of a statement regarding the concession application and the prioritisation of national interest – is the responsibility of the CAB. As a national representative, CABs can handle these processes at their own discretion and are only obliged to consult with the affected municipality. This can result in different boards applying different standards across places and possibly coming to different decisions. Consequently, processes of how CABs assess the situation has been perceived as uneven across territories.

Box 4.2. Sami People of Sweden and mine developments

Missing rights-based legislation on the “duty to consult”, coupled with equalisation of reindeer herding along with minerals extraction as issues of public interest, generates uncertainty and conflict

The Sami are an Indigenous people who have lived for time immemorial in an area that today extends across four countries consisting of the Kola Peninsula in Russia, Northern Finland, Northern Norway’s coast and inland and the northern half of Sweden. This area is collectively referred to as Sápmi (Samiland). The Sami are the only Indigenous people in Sweden and have an estimated population of around 20 000 to 40 000. Sami society – culture, traditions, language and way of life – are unique to the north and form an important cultural asset. The Sami economy in northern Sweden is based on such traditional activities as reindeer husbandry, fishing and hunting, *duodji* (Sami handicrafts) and cultural industries alongside new and emerging opportunities rooted in Sami tradition in such areas as food production and processing, tourism and a range of other industries. Reindeer husbandry is recognised by law as foundational for Sami ventures and culture (OECD, 2019^[12]).

Mining and resource extraction often occur on land used by the Sami people of Sweden for economic and traditional purposes. As such, the relationship between the mining and extractive industries and Indigenous peoples is a critical one. Competing claims over land and natural resources are one of the most complex and acute challenges in the regions of Upper Norrland and are largely related to relations with the Sami people. For instance, in 2016, 99% of the value of the mineral extraction was produced in Sápmi and, to date, 12 mining concession permit applications for large-scale mines are within Sápmi. The fact that many of these concession applications have been outstanding for a number of years creates significant uncertainty for all parties involved (Kaisa, Allard and Lawrence, forthcoming^[22]).

Many Sami fear that with increased mineral development on their transitional land, it is not only their livelihoods that are endangered but also their opportunity to reproduce their history and culture, which is closely linked to the land (Larsen et al., 2017^[23]). For Sami reindeer-herding communities, discussion on land use is often too focused on development in economic terms and does not place value on reindeer herding as central to cultural reproduction for the Sami. To many Sami, the benefits they get from their culture are immeasurable and monetary compensations are not sufficient to secure the sustenance of their culture. Some Sami uphold that the government agencies which make the decisions on mining developments do not have sufficient knowledge of the possible impacts mining can have on their culture and traditional professions, such as including winter and summer grazing areas, migratory routes of reindeer and their metabolism and feeding habits. Sami villages often spend significant time and resources to make their perspectives heard in permitting processes (Larsen et al., 2017^[23]).

Historically, Sami land rights were recognised from the 1600s (tax land). Sweden’s 1971 Reindeer Husbandry Act recognises the Sami reindeer-herding right as a property right based on immemorial prescription – an old property law concept – but this recognition is not furthered into other legislation relevant to mining, such as the Minerals Act or the Environmental Code (Kaisa, Allard and Lawrence, forthcoming^[22]). The Swedish system is based on the notion that different land uses can coexist and that conflicts can be solved locally. Mining development and Sami reindeer husbandry coexist as activities of national interest. However, in practice, there is competition for the same resources and the tools with which to resolve such conflicts are inadequate. Today, the legislative framework recognises Sami land rights as a right to use and only for those who are practising reindeer husbandry. In terms of competing uses for land, they are treated as one of many stakeholders. There is no right of refusal for developments by the Sami on the lands that they use for reindeer husbandry (Kaisa, Allard and Lawrence, forthcoming^[22]).

As part of the United Nations Declaration on the Rights of Indigenous Peoples (2007), the “duty to consult” includes a higher level of influence than what is commonly understood as “consultation”. It

describes a proactive duty of the state to protect Indigenous rights, prior to undertaking actions that may have an impact on these rights. Yet, the exact meaning with regards to the degree of influence of the consulted party of decision is controversial and implementation in decision-making vary between jurisdictions (Larsen and Raitio, 2019^[24]). In Sweden's explanation of vote at the adoption of the United Nations Declaration on the Rights of Indigenous peoples, the Swedish government stated that the duty to consult and co-operate with Indigenous peoples "does not entail a collective right to a veto". Rather, the principle of "free, prior and informed consent" is interpreted as a means to achieve a consultative process, not a standalone right. To resolve this, a Consultation Act is currently under public review and could provide more clarity on the implementation of the "duty to consult" in Sweden (OECD, 2019^[12]).

To date, the methods of this corporate consultation differ and the responsibility for dialogue with local communities, including the Sami, is placed upon the companies and the principles of free, prior and informed consent are not always well respected. Generally, consultation with Sami *samby* is the same as with landowners and holders of special rights other than reindeer husbandry.⁴ The Environmental Code contains regulations for the protection of areas of national interest for reindeer herding and mineral extraction. When there are competing claims for a particular area, regulations in the code specify how to give preference for one use over the other (OECD, 2019^[12]).

The absence of Sami rights to the ownership of land as well as missing rights-based legislation on the "duty to consult" in the mining context, coupled with equalisation of reindeer herding along with minerals extraction as issues of public interest, generates uncertainty and conflict for all parties in northern Sweden. As with other stakeholders, there is no official national government policy, guidance or tools on how mining firms should engage with the Sami. From an international law perspective, reindeer herders are also rights holders as well as being stakeholders; however, free, prior and informed consent is not required in Sweden at present and the decision on the "duty to consult" remains to be taken.

Source: OECD (2019^[12]), *Linking the Indigenous Sami People with Regional Development in Sweden*, <https://dx.doi.org/10.1787/9789264310544-en>; Kaisa, R., C. Allard and R. Lawrence (forthcoming^[22]), "Mineral extraction in Swedish Sápmi: The regulatory gap between Sami rights and Swedish mining permitting practices", *Land Use Policy*; Larsen, R. et al. (2017^[23]), "Sami-state collaboration in the governance of cumulative effects assessment: A critical action research approach", <http://dx.doi.org/10.1016/j.ear.2017.03.003>; Larsen, R. and K. Raitio (2019^[24]), "Implementing the state duty to consult in land and resource decisions: Perspectives from sami communities and Swedish state officials", <http://dx.doi.org/10.23865/arctic.v10.1323>.

Community members who perceive they are feeling heard, listened to and that their concerns are reflected in action show increased acceptance of mining operations. While not all disputes can be resolved through consultation and improved processes and there is a clear need for the government to legislate on unresolved questions regarding Sami land rights to create greater legal certainty (Länsstyrelsen i Norrbottens län och Sweco, 2016^[25]), there are significant benefits to developing meaningful consultation procedures. These include the achievement of consensus through dialogue that provides a better understanding of each other's viewpoints, incentivises the sharing of knowledge and the improvement of social relations (Beland Lindahl et al., 2016^[21]). This can also help to ease a conflict-laden climate, improve decision-making and, in the end, make a region more attractive.

Engagement takes many forms – from information to consultation and, at the most involved level, co-decision-making. More structured engagement processes where there is a real impact on outcomes for those involved will help to build trust among actors. Where differences occur, an open and transparent way to manage conflict is needed, in general, the need for more rigour around how engagement is treated in the regulatory process, including with the Sami people. This is important not just for the mine-opposing groups but also for the industries pursuing development in the north for whom it is unclear with whom they should consult and how and what kind of information is taken into account.

In 2017, the OECD Council recognised the need for a culture of governance that promotes the principles of transparency, integrity, accountability and stakeholder participation in support of democracy and inclusive growth.

It recommends that adherents should:

“grant all stakeholders equal and fair opportunities to be informed and consulted and actively engage them in all phases of the policy cycle and service design and delivery. This should be done with adequate time and at minimal cost, while avoiding duplication to minimise consultation fatigue. Further, specific efforts should be dedicated to reaching out to the most relevant, vulnerable, underrepresented or marginalised groups in society, while avoiding undue influence and policy capture.” (OECD, 2017^[26])

To improve the quality of consultations the national government should develop clear and consistent guidelines for the mining industry on how to conduct consultations with different (interest) groups. Specific guidelines for consultation with Sami people should be developed together with the Sami Parliament and other Sami stakeholders. The guidelines should define how the engagement process should proceed and who should be involved in the process, including parameters around what type of information is provided to parties at each step of the process. It should also make clear to what extent project proponents and the responsible authorities need to take perspectives and positions voiced into account, i.e. ensure that consultations influence the project design.

It is important to note that high levels of engagement, i.e. ensuring that public concerns and aspirations are understood, and partnering with the public in each aspect of the decision, including the development of alternatives and the identification of the preferred solution, have been assessed as being particularly important for complex and difficult problems (Hunt, 2013^[27]; Head, 2007^[28]). To date, this the level of element in consultation is not defined and can be particularly weak in some instances. In the exploration phase, for instance, objections provided do not need to be taken into account in the decision to grant the permit and there is limited control on the ground if the conditions outlined in the work plan are met (Kaisa, Allard and Lawrence, forthcoming^[22]). Further, guidelines should include the imperative that consulting early and widely is essential. This helps companies to identify critical issues and better adapt a project proposal to the local environment and social context.

To ensure that engagement is conducted according to the guidelines and to improve on the perceived legitimacy of the process, the Swedish government should consider introducing an impartial oversight of the process through a dedicated body, agency or person. In France for instance, this role is taken by an inquiry commissioner (*commissaire enquêteur*) who is in charge of assuring neutrality in the consultation process that involves environmental impact assessments. The *commissaire enquêteur* is selected from a list of suitable candidates prepared in advance by a county commission chaired by the president of the administrative court. The administrative tribunal is a court of the first instance with jurisprudence and is independent of the general administration (Chapus, 2008^[29]). Any French person who has registered as an inquiry commissioner must have no conflict of interest in order to be elected. Once elected, the commissioner's tasks are to ensure that the public is properly informed, to collect comments of the citizens, to guarantee the neutrality of the process and to write a progress report and is available to the public for one year (CNCE, 2016^[30]).

In Upper Norrland, this role could be incorporated into a regional platform on resource development (further described from page 152 onwards). Apart from ensuring the processes are conducted based on agreed standards and guidelines, they could also publish all currently ongoing processes and document process outcomes. This could significantly increase the possibility for the public to tackle processes and allows for external follow-ups and assessments in view of increased transparency.

In addition to guidelines, national government actors should also provide detailed information the exact methodology and the process of consultation should be pursued within the framework of the Minerals Act and Environmental Code. This should include how and when notifications should proceed and the nature

of the engagement (format, etc.). With regards to the Sami, Sami representatives, government agencies and mining companies have previously agreed that corporate consultations will not be able to address the lack of recognition of Sami rights in the sectoral legislation (Länsstyrelsen i Norrbottens län och Sweco, 2016^[25]). One potential best practice in this regard is the Norwegian Minerals Act (2009) which has established a formalised mechanism for the Sami Parliament to participate in environmental review processes, including those linked to the government's strategic plans and policies, strengthening the efficacy of the Sami's involvement in EA and promoting the legitimacy of EA processes (OECD, 2019^[12]).

More generally, Canada has early engagement, upstream planning and regional planning as part of its environmental permitting processes (see also Figure 4.2), while in Sweden the stakeholders often meet in regards to individual projects, as required by law. The environmental assessment process in Canada is often used as a channel to discuss development plans and strategies. That is, instead of discussing the specific project, it provides an opportunity to discuss broader issues related to development. Such a more holistic approach to the way consultations are used in impact assessments might also be beneficial in the Swedish context, in particular in combination with aspects relating to cumulative impact assessment and regional land use planning that are dealt with below.

Public engagement takes considerable amounts of time and effort on all sides. Yet, not all actors are equipped with equal resources to engage in constructive negotiations. Creating a level playing field in relation to resources is an important aspect when designing successful processes (Länsstyrelsen i Norrbottens län och Sweco, 2016^[25]). Some companies offer compensation for costs incurred (e.g. paying for peoples' time to properly engage with them), yet there is no general rule on this.

There is also a need to strengthen the capacity of actors affected to be effective partners for engagement. This may entail financial resources alongside some greater overall institutional and analytical capacity to manage demands for consultation in the permitting process. Rules should be put in place defining requirements for companies to pay the cost occurred by affected parties, including de-linking it from the condition to agree with the project or not to appeal a decision. In terms of institutional capacity, one option is for the Sami Parliament to play a stronger co-ordinating role in distributing information to Sami villages with regards to providing contributions to consultation or conducting consultations and making agreements with mining companies. For instance, it could establish a panel of experts/lawyers that Sami villages can draw upon at no or reduced cost. It could also include establishing a register of agreements between mining and energy companies and Sami villages, and templates/guidance to support agreement making. This could help to ensure that negative as well as positive examples are made public. This can improve transparency in the process and encourage peer learning amongst communities that need to deal with similar requests.

To foster information exchange between Indigenous groups as well as between industry and Indigenous peoples, Canadian Indigenous as well as regional and national leaders have invested in a Centre of Excellence for Indigenous Minerals Development. See Box 4.3 for a detailed description.

Box 4.3. Centre of Excellence for Indigenous Minerals Development, Canada

In 2019, Waubetek Business Development Corporation, an Indigenous-led economic development organisation based on the Whitefish River First Nation, initiated the establishment of a Centre of Excellence for Indigenous Minerals Development in Northern Ontario, Canada, together with Laurentian University and the government of Canada.

The centre is designed to function as a pool of knowledge and expertise for Indigenous communities, industry and governments. Its goal is to connect stakeholders and develop partnerships through information sharing on opportunities, risks and best practice protocols for engagement. From the Indigenous side, key interest is to ensure adequate consultation and attain opportunities that might come from developments in a sustainable way, including jobs, joint management and care of the land on which these projects operate. Part of the initiative is a Mining 101, a course to support Indigenous communities to develop the capacity to understand the mineral resources present in their traditional territories and how to engage in the industry. It can also help to share knowledge between Indigenous peoples on previous agreements or engagements with the private sector and foster knowledge building on government and industry side. The centre is financed through a CAN 1.8 million contribution by the government of Canada and with a CAN 1 million contribution from Rio Tinto, an Anglo-Australian mining company that has several mines in Canada.

Source: Regina Leader Post (2019^[31]), "Centre of Excellence for Indigenous Mineral Development set up", <https://leaderpost.com/news/local-news/centre-of-excellence-for-indigenous-mineral-development-set-up/wcm/a84b5c3c-5ee5-471c-b7ab-a9cee39cbf09/> (accessed on 13 March 2020); Northern Ontario Business (2019^[32]), *Rio Tinto commits \$1M to Centre of Excellence for Indigenous Minerals Development*, <https://www.northernontariobusiness.com/industry-news/mining/rio-tinto-commits-1m-to-centre-of-excellence-for-indigenous-minerals-development-1887651> (accessed on 13 March 2020).

Another important aspect to address is the need to ensure that decision-making on prioritisation of national interest does not apply different standards in different places and incorporates regional development perspectives as well as municipal ones. Currently, CABs are given higher levels of discretion in their judgments as they are not obliged to consult with municipalities. This can lead to the application of different standards in different places. To improve this, all decision-makers must have the same high skillset and technical expertise to make highly sensitive and technical decisions that require in-depth knowledge of environmental, social, economic and cultural aspects related to mining. In addition to providing decision-makers with broad and balanced information that can support their decisions, it could also be beneficial to enlarge consultations at this stage of the process. Currently, consultation only happens with municipalities yet, as the following section on land-use will describe, a regional perspective is vital to land use planning and hence, decisions made should also incorporate this perspective as well. To this end, we suggest that a regional platform should be involved in the decision made by the CABs in the mining concession phase to provide the board with a better understanding of regional land use planning objectives as well as ongoing developments and cumulative effects the endeavour might entail for the region.

In this context it should also be stated that collaboration is not linear and that information exchange between stakeholders should not end just because a specific process has ended. Instead, continuous collaboration can result from consultation processes and be beneficial to regional development objectives. This is because challenges may need to be addressed beyond the scope of a permitting process and addressing them requires the interaction of many organisations within a larger system. A best practice example for continuous co-operation between the private sector, local government and civil society is described in Box 4.4.

Box 4.4. The Headland Collective – Stakeholder consultation and regional development based on collective impact

Located in the northwest of Western Australia, Port Hedland is the second-largest city in the Pilbara region and is home to 14 000 people. It is one of the three main iron ore exporting ports in the Pilbara region and ranks as the world's largest bulk export.

To address socio-economic and environmental community concerns, the city decided to introduce a collaborative approach to decision-making together with the mining industry. The approach resulted from the understanding that a common approach was needed to ensure local benefits of resource exploitation. Community consultation to understand local challenges and existing efforts to address them was the first step in this approach. Key challenges revolved around a lack of education and training, employment opportunities, legitimacy of industrial activities (e.g. mining) and positive narratives about life in Hedland.

To address these challenges, the collective brings together a cluster of all stakeholders that are part of economic and social activities in Hedland; to date, 41 organisations have joined the initiative, including private companies, governmental institutions and non-profit organisations. They work together in a collaborative framework in a way that no organisation or individual could do alone.

Across stakeholders, the initiative has identified three priority areas for collaboration:

- Strengthening local employment, training and business development opportunities.
- Co-ordination of social services to further promote the safety and well-being of community members.
- Creating and communicating community vitality and culture.

The Hedland Collective's structure involves organising itself into working groups to address the challenges, each of which deals with the main priorities identified by the collective. These working groups are led by a working group chair headed by a steering committee that is responsible for the strategic oversight of the collective. A general co-ordinator of the collective is selected in agreement with all parties. This co-ordinator plays a key role, supporting the working groups and the steering committee in promoting the established priorities. Due to the nature of the initiative, the diversity of the representation of the sectors is crucial to ensure an equitable distribution of interests. This is achieved by setting up and ensuring equitable representation from all stakeholders including industry, government and community organisations. These organisations also finance the initiative collectively.

An important aspect of the initiative is its approach to evaluate and learn from its work. To this end, the Hedland Collective establishes specific metrics, reviewable, transparent and traceable, indicating progress towards the long-term vision. In the short term, working group meetings are used to develop work-specific metrics according to the priorities listed in the strategies for each area of interest.

Source: Hedland Collective (2020^[33]), *Our Story*, <https://hedlandcollective.com/about-us/> (accessed on 4 June 2020); Pilbara Ports Authority (2020^[34]), *Homepage*, <https://www.pilbaraports.com.au/> (accessed on 4 June 2020).

Strengthening the decision-making process: The inclusion of socio-economic and cultural factors and accounting for cumulative effects

The two major agencies that can take decisions on mines, namely the Mining Inspectorate and the Environmental Court, operate under different objectives and permitting stages. While the Mining Inspectorate is largely focused on assessing the economic value of a potential mine site, the Environmental

Court provides an environmental assessment aiming to protect the environment and assure a healthy and sustainable living environment for present and future generations. Decisions on land use are made at the concession permit stage, while other environmental aspects are considered under the environmental permit stage. This creates highly specialised but also segmented approaches to decision-making that misses important comprehensive considerations important for regional development.

The segmentation has been criticised because the legal assessment of co-existence of potential land-users is made before the impact of the whole project is assessed through an environmental permit. For instance, the Mining Inspectorate and CAB are tasked with weighing overlapping areas of national interest such as natural resources development, nature and/or Sami reindeer husbandry against each other, or investigating ways for possible co-existence despite the fact that potential environmental impact is unclear at this stage. Some researchers fear that this degrades the environmental permitting procedure to primarily setting conditions for mining activities instead of actually being taken into consideration for a concession (Hojem, 2015^[35]; Lawrence and Kløcker Larsen, 2017^[36]).

This regulatory separation is accompanied by the fact that limited consideration is given to economic, social and cultural aspects. Social or economic impact assessments are not required by law and the Environmental Code, which regulates an exploration concession as well as the environmental permit, provides a wide definition of “environment” (Pettersson et al., 2015^[2]; Kokko et al., 2015^[37]). This definition only marginally includes socio-economic as well as cultural elements. According to the Environmental Code, for instance, impact description shall include: “people, animals, plants, land, water, air, the climate, the landscape and the cultural environment, on the management of land, water and the physical environment in general, and other management of materials, raw materials and energy. Another purpose is to enable an overall assessment to be made of this impact on human health and the environment” (Government of Sweden, 2000, pp. 31, Ch. 6^[38]). The same language is used in the guidance document from the Environmental Protection Agency for government agencies and consultants engaging in environmental impact assessments (Swedish Environmental Protection Agency, 2017^[39]).

This use of language implies a focus on the biophysical aspects of the environment. This leaves significant room for interpretation and does not support the investigation of social and economic aspects beyond the physical dimension such as noise, vibrations and other pollutions that might impact physical health (Svensson, 2011^[40]). Yet, other aspects such as changes to community values and/or the way the community functions, impacts on culture, history and ability to access cultural resources as well as changes to livelihoods, for example whether peoples’ jobs, properties or businesses are affected, should be equally considered to provide all-encompassing evaluations.

Similarly, cumulative impacts affecting regional population and economies are also only seldom used in decision-making for mining permits. Cumulative impacts are continuous, incremental and pooled impacts on society, the economy or the environment caused by a variety of activities in the past, present and future. The Swedish Environmental Protection Agency defines cumulative effects as either additive, which means that each effect can be added to a result ($1+1 = 2$), synergistic, which means that the effect of more than one activity is greater than the sum of the effects of each individual activity ($1+1 > 2$) and counteractive, which means that the effect of more than one activity is less than the sum of the effects of each individual activity ($1+1 < 2$) (Swedish Environmental Protection Agency, 2010^[41]). Despite an existing definition, environmental assessment guidelines and legislation only vaguely demand assessment of cumulative impacts and hardly provide guidance on how to approach the aspect. The Environmental Protection Agency itself has made the observation that current policy tools are inadequate and called for improved mapping of multiple land claims and more comprehensive landscape planning (Larsen et al., 2017^[23]). Further, there seems to be significant uncertainty amongst proponents, consultants, reviewers and government officials about what is meant by cumulative effects, how to include them and where to seek information (Wärnbäck and Hilding-Rydevik, 2009^[42]).

The separate assessment of land use and environmental impacts, as well as lacking incorporation of socio-economic and cumulative aspects, can leave decisions contested and increase uncertainty for all stakeholders. Developing a stronger, more balanced evidence base to underpin decisions could be a tool to better define upsides and downsides of a potential mine site. This would require the development of a clear and comprehensive definition of socio-economic and cultural impacts in relation to the Environmental Code. Further, concrete guidelines on processes to follow for their assessments would need to be developed targeting decision-makers as well as project proponents. Examples of how other countries have advanced in this process can be found below.

In order to assess cumulative impacts properly, Canadian research suggests that a framework should be built around the following five aspects:

- *“Multi-dimensional: covers the full suite of cumulative effects of multiple undertakings, past, present and reasonably foreseeable in the relevant regional future (well beyond the individual project level), in light of contribution to sustainability objectives;*
- *Long term: uses scenarios or some equivalent to explore and illuminate the nature and potential implications of plausible and desirable futures, to identify alternative pathways and plan options to examine;*
- *Credible: establishes explicit open processes for elaborating and evaluating regional alternatives and justifying decisions in light of context-specified sustainability-based criteria and trade-off rules;*
- *Authoritative: integrates regional assessment conclusions as decisions in legislatively authoritative regional plans or the equivalent with provisions for ensuring compliance in project-level planning and assessment; and*
- *Accountable: ensures clear and accountable assignment of cumulative effects management responsibilities and expectations, including provisions for engaged monitoring, effective responses and public reporting”. (Atlin and Gibson, 2017^[43])*

When developing the guidelines and assessment processes for cumulative impacts the combined results of past, current and future activities across the landscapes on Sami reindeer herders also need to be considered. There are roughly 3 900 reindeer herders in Sweden. While there are growth opportunities for this industry, it is also limited by such factors as reindeer predators, climate change and competing land uses. Especially, industrialisation and the cumulative effects of forestry, wind and hydropower, mining and infrastructure development have resulted in an extensive reduction of the availability of winter grazing land (lichen-abundant forest) and access to migratory paths for reindeer (Buchanan, Reed and Lidestav, 2016^[44]).

To support decision-making with regards to cumulative effects, measures to account for cumulative impacts on reindeer herding should be developed. A way to achieve this would be to consider the annual reporting on the state of the reindeer-herding sector (total herd size, rate of slaughter, amount of feed, etc.) that is prepared by the Sami Parliament in decision-making for cumulative effects under the Environmental Code and the Minerals Act. Further additional reporting on aspects like grazing lands and migrating routes should be included. Existing Reindeer Husbandry Plans (*Renbruksplaner*, RBP) could be a tool to monitor and capture cumulative effects these plans are conducted with the help a database call RenGis. RenGis is a specially developed data programme designed for the collection of land use information reported by reindeer-herding communities. The data shows how the land is being used and when, for instance through GPS collars that reindeers wear. Currently, the Sami Parliament is working on a new geographic information system (GIS) platform so that all RenGis data can be centrally and securely stored. In this portal, each community can decide which data to share publicly and which shall remain undisclosed. In the future, the Sami Parliament, being granted access to the data form communities, could provide better and more accurate documentation when asked for advice from other government agencies in land use and permitting decisions. It would be advisable to consequently use this new database as well as already available RBPs for decision-making on land use in permitting processes, not only those related to Sami villages.

Further, guidelines on the assessment of cumulative impacts as well as social and cultural effects of mining on traditional Sami livelihood should be co-developed with Sami representative bodies and with respect to traditional Sami knowledge on land use. Further, the concept of community-based impact assessments that allows Sami villages to conduct an impact assessment on their own terms can provide an alternative to proponent-driven impact assessments and should be considered in developing clearer definitions.

There are several examples from across OECD countries that have already developed this measure, as there is an increasing consensus for the need to integrate several issues when performing impact assessment. Some countries require social impact assessments (SIAs) coupled with EIAs, while others have decided to create overarching impact categories that include all aspects. Box 4.5 provides an example from Australia where the state of Queensland has developed separate but very detailed descriptions of what needs to be provided in an economic and social impact assessment. In Canada, the government has proposed changes in 2019 to further improve its environmental review process. The key objective is to create greater transparency and certainty in decision-making, including through changing the previous environmental assessment to impact assessment that includes environmental, health, social and economic impacts. For instance, the Canadian Environmental Assessment Agency became the Impact Assessment Agency of Canada responsible for leading all assessments. This shall also reduce red tape and enable better co-ordination amongst jurisdictions. The new system also requires an assessment of the impacts of a project on Indigenous peoples and their rights and includes a cumulative effects assessment. Regional assessments would be undertaken to guide the planning and management of cumulative effects. This helps to better understand the “big picture” to guide regional planning processes (see Figure 4.2).

Box 4.5. Economic and social impact assessments in Queensland, Australia

The state of Queensland, in Australia, requires social – and economic impact assessments. Both are subject to all projects that require an environmental impact investigation. The assessments are used to inform the decision of the Co-ordinator-General of the state who is to approve large resource projects. The assessments help him or her to evaluate projects and decide whether or not a project is to proceed. A key objective of the information collected is to identify the key economic and social impacts of the project – both positive and negative – and require analysis, assessment, management and monitoring.

The government has published detailed guidelines for both processes. The guide for the SIA outlines different phases of the process and discusses the key matters and the detail of analysis required. The social impact is defined as the “direct and indirect impacts that affect people and their communities during all stages of the project lifecycle”. The SIA must cover:

- Community and stakeholder management.
- Workforce management.
- Housing and accommodation.
- Local business and industry procurement.
- Health and community well-being.

In terms of well-being, for instance, it requires an analysis of the availability, accessibility and capacity of and an assessment of potential project impacts on (select):

- Existing social services, facilities and infrastructure, including healthcare, transport and education; an analysis of the health and well-being of potentially impacted communities.

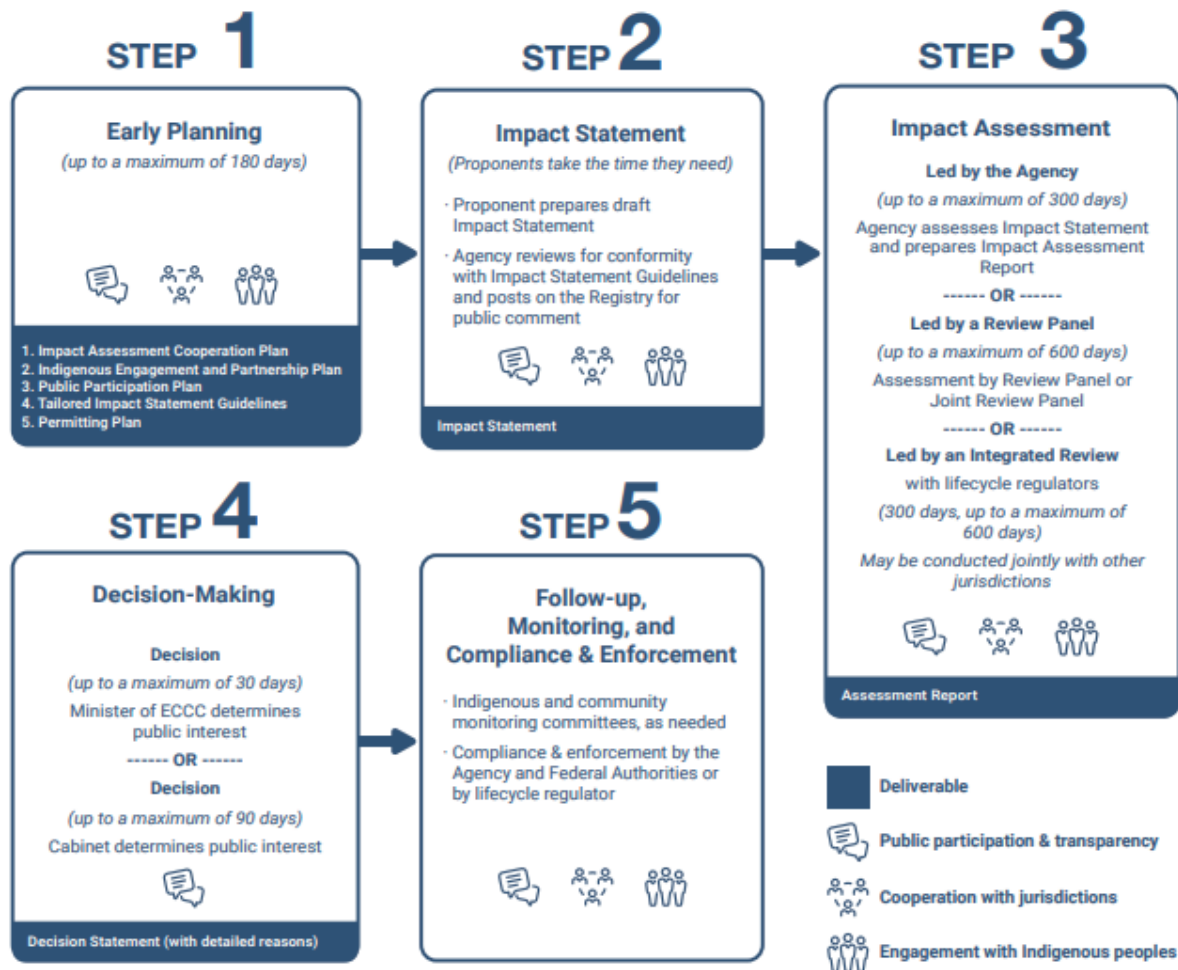
- Community health, safety and security, environmental factors such as air quality, noise and water, livelihoods, economic well-being and access to resources, community lifestyles and cultural practices and community cohesion.

Similarly, also a guideline on EIAs is available to inform proponents, key stakeholders and the community about the information required for the Co-ordinator-General to evaluate the economic impacts of the project. It is composed of two parts, for which it outlines acceptable methodology:

- Regional impact analysis (RIA), which is used to describe the size and nature of the effects on local, regional and state economies. This includes the level of stimulus to the regional and state economy, the level and location of employment change through direct and labour inputs as well as the projected effects on the local economy, including housing, labour costs and services.
- Cost-benefit analysis (CBA), which is used to identify the costs and benefits of the project. This tries to identify all the outcomes (positive and negative) that might arise from the proposed project and the changes it entails. These might include a range of economic outcomes, environmental impacts, social impacts and other changes that are important, such as costs to the government of supporting infrastructure. The process applies a monetary value to these outcomes so they can be compared. It also includes a sensitivity analysis, which analysis of distribution effects, and the sensitivity of outcomes to different assumptions such as discount rate.

Source: Office of the Coordinator-General (2017^[45]), *Economic Impact Assessment Guideline*, <http://www.statedevelopment.qld.gov.au> (accessed on 13 February 2020); Queensland Government (2018^[46]), *Obligations for Large Resource Projects*, <https://www.statedevelopment.qld.gov.au/coordinator-general/strong-and-sustainable-resource-communities/requirements-for-large-resource-projects.html> (accessed on 13 February 2020); Office of the Coordinator-General (2018^[47]), *Social Impact Assessment Guideline*, <http://www.statedevelopment.qld.gov.au> (accessed on 13 February 2020).

Figure 4.2. Proposed new system in Canada, 2018



Note: Regional strategic assessments would be proactively conducted outside of individual project reviews. This will help inform project assessments, manage cumulative impacts and support decision-making.

Source: Government of Canada (2018^[48]), *Better Rules for Major Project Reviews*, <https://www.canada.ca/en/services/environment/conservation/assessments/environmental-reviews/environmental-assessment-processes/ia-handbook.html> (accessed on 14 February 2020).

This being said, it has to be noted that measures suggested will not be sufficient to address more substantive regulatory gaps in the system revolving around the separation of the process in which decisions on mining concessions are made without concrete knowledge of the environmental impact and that this decision cannot be adjusted afterwards. A revision of this setup could be envisioned to further streamline the process, into one permitting process for instance. One option to be considered is reducing the fragmentation of the process, not only to reduce complexity for all involved parties but also to fundamentally strengthen a more comprehensive approach to impact assessment including cumulative aspects that are an essential part of considering regional development objectives and outcomes. This would mean reducing the permits to two, one for the scoping phase and one for opening a mine, and include a fundamental shift in the approach to the process from mitigating adverse effects to build consensus on actions that facilitate sustainable growth. This shift requires the development of fundamental links to a strong regional planning framework. Recommendations on how to improve regional planning are made throughout this report in Chapter 3 as well as the next section of this chapter.

Linking land use planning with regional economic development

Spatial and land use and special planning is closely connected to much broader agendas such as the transition to a low carbon economy and creating opportunities for economic growth and prosperity. Defining how spaces are used also determines if objectives such as producing renewable energy, providing affordable housing, producing goods and services or sustaining biodiversity can be reached. It is therefore linked to policy ambitions at multiple scales, extending across sectoral issues and involving an ever-wider array of actors in structures of governance (OECD, 2017^[49]).

Landscapes in Upper Norrland are characterised by multifunctionality and need to be governed in a way that reflects the heterogeneous range of land use values (Solbär, Marcianó and Pettersson, 2019^[50]). Spatial planning provides long-term frameworks to outline land uses and infrastructure connections. Fostering the growth of the mining industry may require new transport and communications linkages and the protection of environmental assets and amenities. This can also impact the capacity to develop areas for tourism and recreation. Hence, special planning also needs to reflect regional development goals and vice versa.

The analysis in Chapter 2 has shown that Norrbotten and Västerbotten seem to face challenges in terms of land availability for construction of housing. Especially in Norrbotten, many municipalities face challenges in developing new housing projects and increasing the housing stock. Between 2000 and 2012, the dwelling stock in Norrbotten experienced a decrease of 3%. At the same time, economic development strategies for both counties include enhancing the attractiveness and supporting innovation and entrepreneurship to advance the sustainable development agenda (Chapter 3). If the counties are to incentivise business creation and counteract their population decline in rural areas, these policy goals also need to be reflected in the designation of land for these purposes.

This section investigates how to better link regional development with land use planning in Upper Norrland. It assesses recent sub-national governance reforms of economic development and highlights the fact that economic change, like expansion or introduction of extractive industries, generates new land use and infrastructure requirements that need to be accounted for in land use planning.

Recent reforms strengthen the role of regions in Sweden but an important gap between land use planning and regional development strategies persists

In Sweden, the sub-national governance level is made up of two levels: counties and municipalities. Both act as self-governing entities under the central government, which means that municipalities are not subordinate to counties. Historically, the main task of Swedish county councils was healthcare provision. Municipalities are responsible for education and elderly care as well as land use planning. In addition, CABs are also present in counties, as national government agencies tasked with ensuring the co-ordination of national policies. They play a key role in facilitating co-ordination between municipalities and counties and across different policy domains. Co-ordination also tends to be organised in a sectoral way with limited the capacity for co-ordination across different policy areas (OECD, 2017^[51]; 2017^[52]).

Over the last decade, Sweden has shifted towards an approach to regional policy in which county councils are taking the lead in regional development including in regional growth policy, transport and infrastructure. This change was made to address challenges of policy co-ordination at the county level and amongst levels of government. This means that responsibilities previously held by CABs were shifted to counties (see Table 4.3) for an overview of the governance arrangements) (OECD, 2017^[51]).

In the counties of Västerbotten and Norrbotten, two slightly different systems exist as a result of this change. Västerbotten has a Regional Development Council (Region Västerbotten), established by the county council and the county's 15 municipalities in 2008. The political representatives of the county and the municipalities indirectly elect members of the Regional Development Council. The role of the council

includes formulating the region's development strategy and co-ordinating its implementation, ensuring the alignment of efforts with national policies, and monitoring and reporting on results. In Norrbotten, since 2017, the county council (directly elected) is taking the lead on regional development and has become Region Norrbotten (see Table 4.3 for an overview of the governance arrangements). When county councils take on the responsibilities of regional development, they are allowed to rename themselves as a region (OECD, 2017^[51]; 2019^[12]).

Table 4.3. Governance arrangements for regional development and land use planning in Västerbotten and Norrbotten

Institution	Governance arrangements
Country Administrative Board Norrbotten	Oversees processes on mining permits, national interest areas and grants municipalities the rights to develop their land based on this.
Country Administrative Board Västerbotten	Oversees processes on mining permits, national interest areas and grants municipalities the rights to develop their land based on this.
Region Norrbotten (county council)	The Regional Development Council (Region Norrbotten) has lead responsibility for regional development since 2017.
Region Västerbotten (county council)	The Regional Development Council (Region Västerbotten) has lead responsibility for regional development since 2008.
Municipalities	15 municipalities in Region Västerbotten and 14 municipalities in Region Norrbotten create comprehensive plans for land use in their areas.

The reform has enabled the counties of Västerbotten and Norrbotten to develop a collective view about their development futures. Yet, these priorities and visions are not always reflected or considered in how land is planned, as responsibilities for competencies related to economic development and land use sit with different government bodies. Moreover, the regional development programme offers an umbrella structure but tends to lack the physical planning perspective. Previous OECD reports have already pointed to the fact that the Swedish system lacks a clear framework or incentives to facilitate the development of strategic spatial plans at a regional scale (OECD, 2018^[53]; 2017^[51]). In order to deliver on its regional development objectives, there is a need to better link regional development with land use and environmental planning.

In Sweden, municipalities have three main responsibilities related to land use. They are responsible for local planning through plans, for the provision of housing through public housing companies, and they provide the technical infrastructure required to develop the land, such as roads and water and sewage disposal networks. In cases where municipalities own land, this gives them the opportunity to directly choose how they want to use it or if they want to sell it for development. Municipalities are required to develop comprehensive plans and detailed plans. The comprehensive plan sets the strategic framework for the detailed development plan, which is a legally binding instrument setting out rights and obligations regarding the use of land. Comprehensive plans cover the entire territory of a municipality and form the basis of decisions on the use of land and water areas. Since April 2020, amendments have been made which furthers the comprehensive plan as a tool for visionary and strategic decisions that co-ordinate superior national and regional goals, programmes and strategies (Swedish Government, 2020^[54]). There is now a set time limit for when the comprehensive plan is considered to be current and up to date and municipal councils need to make a “planning strategy” for each term, which includes a revision of the plan. The comprehensive plan-making is supervised by the national government through the CABs. CABs check the compliance of comprehensive plans with national guidelines (such as areas of national interests). The statement of the CAB forms a compulsory planning document within the comprehensive plan (OECD, 2017^[49]). The main formal co-ordination mechanisms between levels of government and other relevant actors and stakeholders are mandatory consultations that occur in the plan-making process and before

granting building permits. In practice, consultations are channelled through the CABs, which play a co-ordinating role (OECD, 2017^[55]).

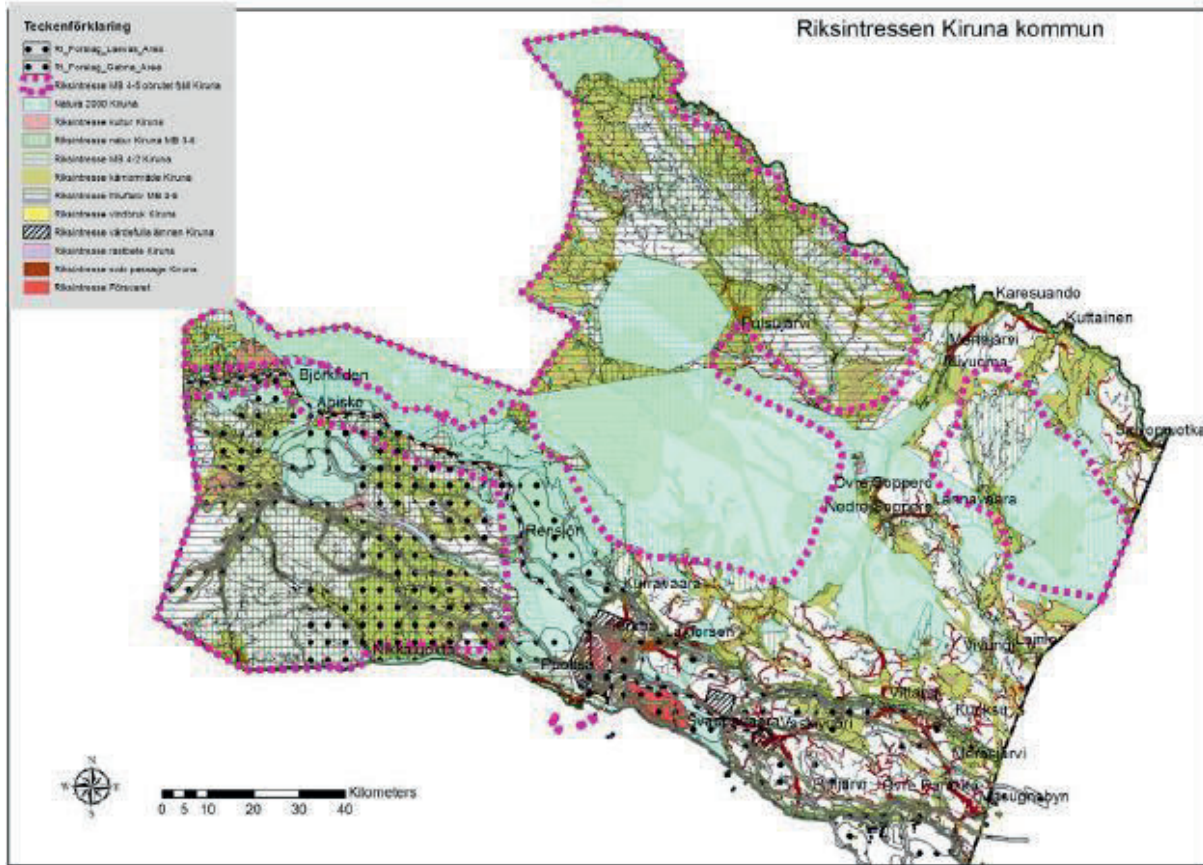
This system has been described as imbalanced between actors, top-down and disincentivising active land use planning because local planners are often unclear which national interests will be judged as prevalent or possible in co-existence by the CAB. The vagueness of the provisions in the Environmental Code (also discussed in the previous section) tend to causes planners to delegate the decision to space-specific authorisation procedures and discourages planning based on potentials and opportunities, often leaving the wider countryside “unplanned” (Solbär, Marcianó and Pettersson, 2019^[50]).

In Kiruna, for instance, the entire city needs to relocate due to mine expansion underground. This has triggered an urban transformation process of unprecedented scale and has created the need for in-depth land allocation and planning processes. Despite the fact that the municipal area is quite large, 20 551 km² in total, the city is lacking land for the development of industry and settlements. This has two reasons. First, the city owns less than 1% of municipal land and has thus limited leeway for investments. Second, large parts of the city are overlaid by areas of national interest (see also Figure 4.3). This means that planning for housing space, sewage facility locations, transport routes and development of alternative industries for instance, almost always encounters areas of national interest. While the designation as areas of national interest does not prevent development per se, it does limit local planning flexibility and often forces decision-making on a case-by-case basis. This is because areas of national interest are governed and managed by specific national governmental agencies or national boards. Consequently, local government cannot actually plan for the management of these types of land use as they require national decision-making (Bjärstig et al., 2017^[56]).

The need for better special planning at a regional scale and increased co-operation

In order to realise the benefits of spatial planning, Norrbotten and Västerbotten need to create an effective policy framework that allows for strategic dialogue about land use between municipalities, counties and CABs. This is also important because the boundaries of administrative areas such as municipalities do not necessarily relate to the functional and economic flows across the land. Changes in demand for the use of land do not start and stop at administrative boundaries. Mineral deposits, reindeer herding as well as transport systems, stretch across various governmental and geographical boundaries. Hence planning for related polices may not sit well with spatial plans for growth at the municipal level. Movement of people and goods and flows of services are increasingly difficult to handle through investment decisions and strategies that are bounded within a local planning framework (OECD, 2017^[49]).

Figure 4.3. Areas of national interest in Kiruna municipality



Note: 83.6% of Kiruna's municipality is covered by areas of national interest defined by Chapter 3 of the Environmental Code and 55% by Chapter 4 designations (Solbär, Marciano and Pettersson, 2019^[50]).

Source: Municipality of Kiruna (2019), Presentation OECD Study Visit November 2019.

So far, the new Planning and Building Act from 2 May 2011 includes provisions to better link municipal comprehensive plans with regional development programmes but its binding power remains limited in practice (OECD, 2018^[53]). Developing strategic spatial plans at a regional scale can help to better account for interrelationships at a functional or regional scale. Developing these plans can increase co-operation between sub-national government entities and, consequently, align land use planning and regional development economic development programmes. It can also help balance municipal and regional with national interests and encourage more forward-looking planning, allocating a competency to the body responsible for regional development to produce a regional spatial plan and ensure it is integrated with planning for future natural resource use and Sami land use. Box 4.6 provides an example of such a land use mechanism that is used in the region of Skåne.

Box 4.6. A spatial planning initiative at the regional scale – An example from Skåne

Since 2005, the Skåne Regional Council has taken a leadership role in developing a collaborative regional approach to spatial planning in partnership with local municipalities in the region.

The Structural Picture of Skåne was initiated as a project in 2005 and formalised as part of the operations of the region and Skåne's 33 municipalities in 2011. The aim is to link the region's regional development strategy with the municipalities' land use planning. This has provided a platform for information sharing and dialogue between the regional and local levels, including a Skåne knowledge base on physical planning across municipal boundaries. In 2014, the Strategy for a Polycentric Skåne was introduced. It consists of five strategic areas which are important for regional development: polycentric structure, accessibility and transportation, land use, attractive environments and Skåne's relations to its surroundings.

The Structural Picture of Skåne has been underpinned by a significant amount of dialogue and joint work. This has created a common knowledge base between the region and the 33 municipalities, which includes common data and spatial analysis. The Structural Picture of Skåne is a good practice example of taking a regional approach to strategic land use and infrastructure planning.

Questions of geographic scale are important for land use planning because economic interactions often spread beyond administrative boundaries. This can create co-ordination problems in decision-making about land use, public services and infrastructure where responsibilities lie with local municipalities.

Source: OECD (2018^[53]), *OECD Territorial Reviews: The Megaregion of Western Scandinavia*, <https://dx.doi.org/10.1787/9789264290679-en>.

A regional special plan can also help to improve decision-making with regards to extractions for commodity production and conservation of social and biological assessments. This is because plans at the county level could offer a holistic description of how land is currently used and what is planned for the future. This way, regional plans can help to account for cumulative impacts. The land use needs of Sami communities should be considered within land use planning. The scale of these plans should be at the country level as each county has developed individual regional economic development plans. Yet, considering potentially shared goals for economic development between countries and the fact that there might be interrelationships stretching across counties, enlarging the collaboration to Norrbotten and Västerbotten could be considered. Further, offering strategic dialogue opportunities with the national level is equally important, especially with regards to the development of a new national mining strategy (see Chapter 3). Involving the CABs and other national-level bodies, through a conference on spatial planning for instance, can provide a broader vision and guidelines to all constituencies. An example of such a process from Austria can be found in Box 4.7.

Box 4.7. The Austrian Conference on Spatial Planning

The Austrian Conference on Spatial Planning (*Österreichische Raumordnungskonferenz*, ÖROK) is an organisation dedicated to co-ordinating spatial planning policies between the three levels of government in Austria (the national level, the states and the municipalities). Its decision-making body is chaired by the Federal Chancellor and its members include all federal ministers, the heads of all federated states and representatives of associations of local governments. Furthermore, business and labour organisations are represented on the body as consulting members. The work of the decision-making body is supported by a permanent secretariat with a staff of approximately 25-30. One of the central

tasks of the ÖROK is the preparation of the Austrian Spatial Development Concept (*Österreichisches Raumentwicklungskonzept*, ÖREK), which covers a planning period of approximately 10 years and provides a vision and guidelines for spatial development that is shared by all levels of government. Beyond the preparation of the Spatial Development Concept, the ÖROK also monitors spatial development across Austria. It has developed an online tool that provides a mapping function of a variety of important indicators at the municipal and regional levels and releases a report on the state of spatial development every three years. The ÖROK is also the co-ordinating body for structural funds provided by the EU for the programming work related to 1 of the 11 thematic objectives of the programming period 2014-20. The ÖROK also serves as a national contact point within the framework of European Territorial Co-operation.

Source: ÖROK (2015^[57]), "Österreichische Raumordnungskonferenz/ Austrian Conference on Spatial Planning", <https://www.oerok.gv.at/>

Developing a platform for resource development to facilitate regional, sustainability-based planning for mining and resource projects

Developing a unified view on a sustainable future of mining development as described in Chapter 3 also needs regional planning for implementation. As discussed above, there is a need to better reflect the county perspective in the regulatory framework, especially when aiming to better account for cumulative effects. A prerequisite for this is to have a county understanding of three things: i) objectives defined through regional development strategies; ii) an agreed special plan on the county level that incorporates implications for developments across municipal borders and allows making use of policy complementarities and synergies; and iii) information and data about existing, currently planned and possible future projects at county scale. In the current system, much of this information is available but dispersed across institutions and drawn upon only in individual instances but not in a structured process. This hampers the execution of integrated, regional mine development that lives up to the highest standards of sustainability and legitimacy.

In addition, the complex system and large number of responsible authorities and regulations applicable for a mining permit in Sweden can make it challenging for companies to find the right contact point when they are seeking information and guidance on the process. While the Geological Survey of Sweden provides services in relation to parties involved in mining activities, including all geological data, taking care of prospecting and making them publicly available, assisting with information and guidance in the application process, it does not give advice on all aspects and can merely provide referrals. In contrast, in the application process itself, the CAB often plays an important role in terms of co-ordination between stakeholders, because it represents the national government on the ground, conducts inspections and manages engagement processes, and acts as a supervising authority (Nike et al., 2019^[58]). This happens even though it needs to make recommendations on developments.

To improve interactions between proponents and government agencies as well as systematically address the link between regional developments and permit applications, a regional platform for resource development in Upper Norrland or each county could be set up. The platform would oversee all mining (and possibly other infrastructure and energy) applications and could not only help to reduce frictions amongst multiple reviews and entities involved but also help to better link development across the counties and possibly beyond. While applications could still be assessed on a case-to-case basis considering local circumstances, these would be embedded in knowledge about other plans or ongoing developments in the two counties. The platform would encompass two essential tasks:

- First, the agency could function as a contact point for all stakeholders, including proponents for mining project and landowners, rights holders and the general public including mining companies, for questions on the permitting process as well as for consultation. Other counties specialised in

mining increasingly opt for solutions that offer digitally supported interfaces to streamline processes (see Box 4.8). The body could be used to move the oversight of the corporate consultation processes as a “neutral” body. Currently, consultation processes are largely left under the responsibility of companies that have received limited guidance on how to proceed. Further, opportunities for publishing all ongoing consultation processes as well as outcomes could improve transparency and allow for follow-ups and assessments.

- Second, the agency could collect and publish information on all ongoing developments in the territory, keeping track of potential cumulative impacts that need to be taken into account in impact assessments and provide the CAB with guidance on decisions made on land use about areas of national interest. Having oversight about all ongoing projects would enable decision-making to become more coherent and all-encompassing. For instance, as cumulative impacts of developments are easily overlooked (see also section on cumulative impacts), they would become detectable and ad-hoc and informal co-ordination across actors could be replaced by formal governance arrangements. This could also enable the two counties to consider policy complementarities and synergies between projects from different industries. The expansion of the mining industry could, for instance, increase the demand on infrastructure such as railways and roads that pass through large territories. Previous capacity expansions have been reported to only cover 60% of the needs and additional expansion required in the future (SveMin, 2012^[4]). The platform could consider these needs and impacts in accordance with other impacts of different actions and the intended policy outcome, and feed them into regional development and land use planning processes. An online data portal could support the work by including a list and/or map showing in which areas permitting processes are ongoing and what types of land use are being considered. Considering drawing on the land use mapping data tool currently under development by the Sami Parliament and Sami villages is highly recommended.

Institutionally, the platform could be linked to the national government but should be run at country scale by country actors and municipal representatives. It should be developed in partnership with local and regional authorities, academia as well as all affected actors including the Sami, to assure legitimacy when taken to use. In collecting information about ongoing projects, it should link to information available from national websites such as the Mining for Generations – Mining by Sweden.

Following a successful introduction of the platform at county scale, expansion to the entire Norrland region would also be possible. This would have to be assessed based on the need for further cross-country collaboration with regards to achieving mutual economic development objectives, accounting for cumulative effects as well as realising policy complementarities, for instance with regards to infrastructure development.

Box 4.8. Examples for (digital) one-stop-shops for permit applications

Cumbersome permit application processes are a challenge for many OECD Countries. To address this, countries and territories are increasingly opting for “one-stop-shop” systems that aim to streamline their processes. A key element of the latest systems is the use of digital services that convey important information to several authorities simultaneously.

Perú, for instance, is setting up technical solutions to improve the timeliness with approvals for mining investment projects as part of their digital government initiative. A “digital single window” approach provides investors with one channel to manage all necessary permits and authorisations. The interface brings together the work of five government ministries and agencies that are responsible for exploration and exploitation activities, evaluation of mine closure plans, and managing environmental liabilities. The

goal of this is to reduce the number of administrative procedures and transaction costs and allow for timely responses and greater predictability.

Similarly, Finland is currently developing a similar system called the National Supervisory Authority. Its implementation is scheduled for 2021. The key goal is the smooth transfer of information between multiple partners. It will serve as a single point of contact for companies as well as involved authorities. The change will not require any legislative changes to the overall process but only small specifications have been made. For example, mine maps no longer need to be sent to the authorities every year but only when necessary and when mining operations are discontinued.

Countries such as Greenland, Italy, Perú and Portugal already have such a system. In Greenland, for instance, the Bureau of Minerals and Petroleum (BMP) is the authoritative body for all administration in relation to the mineral resources industry. Licensees, therefore, only have to apply to this one place to obtain necessary licences. The one-stop-shop policy ensures an efficient administration in the area of mineral resources. In the SIA process, BMP has the regulatory authority to review, evaluate and approve according to these guidelines, as well as to facilitate public hearing processes.

Source: Ahlbland, J. (2017^[59]), "A more direct route for permit applications – GeoFoorumi", <http://verkkolehti.geofoorumi.fi/en/2017/10/a-more-direct-route-for-permit-applications/> (accessed on 15 February 2020); Instituto de ingenieros de minas del Perú (n.d.^[60]), "Minem anuncia Ventanilla Única Digital para agilizar inversiones mineras", <https://iimp.org.pe/promocion-minera/minem-anuncia-ventanilla-unica-digital-para-agilizar-inversiones-mineras> (accessed on 16 February 2020); Raaness, A. et al. (2017^[61]), "MinLand: Mineral resources in sustainable land-use planning - Synthesis of case studies", <http://www.minland.eu> (accessed on 14 February 2020); Bureau of Minerals and Petroleum (2009^[62]), *Guidelines for Social Impact Assessments for Mining Projects in Greenland*, <http://www.bmp.gl> (accessed on 13 February 2020).

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Notes

¹ Antimony, arsenic, beryllium, lead, caesium, gold, iridium, iron occurring in the bedrock, cobalt, copper, chrome, mercury, lanthanum and lanthanides, lithium, manganese, molybdenum, nickel, niobium, osmium, palladium, platinum, roodium, rubidium, ruthenium, silver, scandium, strontium, tantalum, tin, titanium, thorium, vanadium, bismuth, tungsten, yttrium, zinc, zirconium, andalusite, apatite, brucite, fluorite, graphite, kyanite, ceramic or refractory clays, magnesite, pyrites, nepheline syenite, sillimanite, pit coal, rock salt or other salt occurring in a similar way, iron pyrites, heavy spar, wollastonite, oil, gaseous hydrocarbons and diamond.

² The term sameby (or samebyar for plural) which translates to Sami village or Sami reindeer herding community is used throughout this report to describe the economic and administrative association created to organise reindeer husbandry within its geographic area. The Swedish terminology is preferred here since the English translation inaccurately connotes that members of the sameby live in proximity to one another.

³ Please note that this is a shortened and simplified summary of the case, used for the illustration of one particular challenge in the regulatory framework.

⁴ During the consultations, they have the possibility to raise objections to the planned operations and request that permits are subjected to special conditions to limit the impact on reindeer herding in the area. As of 1 August 2014, the Minerals Act has been modified so that, if requested, the plan of operations (required before any exploration can start) must be provided in Sami language. In addition, a valid plan of operations must be sent to the Sami Parliament.

OECD Rural Studies

Mining Regions and Cities Case of Västerbotten and Norrbotten, Sweden

Sweden's northern region, Upper Norrland, is one of the most important mining regions in Europe and has the potential to become a global leader in environmentally sustainable mining. With the largest land surface and the lowest population density in Sweden, Upper Norrland contains two sub regions, Västerbotten and Norrbotten. Both sub regions host the greatest mineral reserves in the country, containing 9 of the country's 12 active mines and providing 90% of the iron ore in the European Union. Upper Norrland has the potential to become a global leader in environmentally sustainable mining due to its competitive advantages, including a stable green energy supply, high-quality broadband connection, a pool of large mining companies working closely with universities to reduce the emissions footprint across the mining value chain, and a highly skilled labour force. Yet, the region must overcome a number of bottlenecks to support a sustainable future, including a shrinking workforce, low interaction of local firms with the mining innovation process and an increasing opposition to mining due to socio environmental concerns and land use conflicts. This study identifies how Västerbotten and Norrbotten can build on their competitive advantages and address current and future challenges to support a resilient future through sustainable mining.



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