

# Sustainable development and Sustainable Development Goals in Smart Specialisation strategies in the European Arctic regions



This publication is a report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The contents of this publication do not necessarily reflect the position or opinion of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication. For information on the methodology and quality underlying the data used in this publication for which the source is neither Eurostat nor other Commission services, users should contact the referenced source. The designations employed and the presentation of material on the maps do not imply the expression of any opinion whatsoever on the part of the European Union concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

#### Contact information

Michal Miedzinski  
Joint Research Centre, European Commission  
[Michal.Miedzinski@ec.europa.eu](mailto:Michal.Miedzinski@ec.europa.eu)

#### EU Science Hub

<https://joint-research-centre.ec.europa.eu>

JRC132932

PDF ISBN 978-92-68-01069-3 doi:10.2760/671740 KJ-08-23-035-EN-N

Luxembourg: Publications Office of the European Union, 2023

© European Union, 2023



The reuse policy of the European Commission documents is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Unless otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of photos or other material that is not owned by the European Union, permission must be sought directly from the copyright holders.

How to cite this report:

Teras, J., Eikeland, S., Koivurova, T. and Salenius, V., *Sustainable development and Sustainable Development Goals in Smart Specialisation strategies in the European Arctic regions*, Teras J., Salenius V. and Miedzinski, M. editors, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/671740, JRC132932.

# Contents

ABSTRACT .....	1
ACKNOWLEDGEMENTS.....	2
EXECUTIVE SUMMARY .....	3
INTRODUCTION.....	6
1. THE ARCTIC CONTEXT.....	9
1.1 Defining the European Arctic regions.....	9
1.2 Regional development in the European Arctic.....	11
2. SUSTAINABLE DEVELOPMENT AND THE EUROPEAN ARCTIC.....	17
2.1 The Sustainable Development Goals and the European Green Deal.....	17
2.2 Placing the EGD and SDGs in the Arctic context.....	19
3. SMART SPECIALISATION FOR SUSTAINABLE DEVELOPMENT IN THE EUROPEAN ARCTIC.....	21
3.1 Smart specialisation in the Arctic.....	21
3.2 Addressing sustainability challenges in S3 in the Arctic.....	24
4. SMART SPECIALISATION AND SUSTAINABLE DEVELOPMENT IN THE ARCTIC.....	28
4.1 Northern Finland- Lapland .....	28
4.2 Northern Sweden.....	34
4.3 Northern Norway.....	41
4.4 Cross-case synthesis.....	53
5. CONCLUSIONS.....	55
6. POLICY RECOMMENDATIONS .....	61
REFERENCES.....	64
LIST OF ABBREVIATIONS .....	68
LIST OF BOXES.....	69
LIST OF FIGURES.....	70
LIST OF TABLES.....	71

# Abstract

This report provides a general analysis on how sustainability challenges and Sustainable Development Goals are embedded in ongoing Smart Specialisation processes in the European Arctic at regional and local level. The report provides insights into Arctic smart specialisation strategies and offers illustrative case studies of projects and initiatives relevant to achieving sustainable development in Arctic Finland, Arctic Sweden and Arctic Norway.

## Acknowledgements

The authors wish to thank the following experts who have kindly contributed additional insights and data to the process of compiling this report: Per-Erik Andersson (Region Norrbotten), Hilde Skjerven Bersvendsen (Troms and Finnmark county council), Håkon Dahlmo (Troms and Finnmark County Council), Maria Hakkarainen (University of Lapland), Helena Holmgren (Luleå Business Region/ TreePower), Kristiina Jokelainen (SmartNorth company), Natalia Karlsen (Troms and Finnmark County Council), Åge Mariussen (Nordland Research Institute), Tor Björn Minde (RISE ICE Datacentre Luleå), Kaarina Mäcklin (Regional Council of Lapland), Anna Norin (Region Västerbotten), Anna Odevall (Swedish Lapland Visitors Board), Hanna-Leena Pesonen (Regional Council of Lapland), Tuomas Pussila (Digipolis), Terje Stabæk (Nordland County Council), Carl Wangel (TreePower), Egil Ørjan Thorsen (Troms and Finnmark County Council).

The authors express their gratitude to the regional experts who contributed with their insight during the feedback workshop hosted by the EU JRC, held as a webinar on 12 December, 2022: Hilde Skjerven Bersvendsen (Troms and Finnmark County Council), Håkon Dahlmo (Troms and Finnmark County Council), Timothy Heleniak (Nordregio), Kaarina Mäcklin (Regional Council of Lapland), Anna Norin (Region Västerbotten), Una Sjörbotten (Nordland County Council).

### **Authors**

Jukka Teräs

Sveinung Eikeland

Timo Koivurova

Viktor Salenius

### **Editors**

Jukka Teräs

Viktor Salenius

Michal Miedzinski

## Executive summary

This report provides insights on how Arctic smart specialisation strategies developed at regional level address sustainable development challenges and the Sustainable Development Goals (SDGs). The study offers examples of relevant projects and initiatives drawn from Arctic Finland, Arctic Sweden and Arctic Norway.

The revised EU Arctic Policy highlights smart specialisation as an important approach for innovation policy helping to strengthen the capacity and resilience of the European Arctic societies and economies (European Commission, 2021). With its overarching goals to foster structural transformation, smart specialisation strategies are among important policy tools fostering the achievement of the goals of the European Green Deal (European Commission, 2019a) Smart specialisation oriented towards broader sustainability challenges aligns with the overarching mission of EU Cohesion Policy to improve social inclusion and strikes the chord with the SDGs and the core principle of the 2030 Agenda for Sustainable Development “to leave no one behind” (UN, 2015).

The specific conditions of the Arctic regions mean that policy processes require significantly different implementation mechanisms to fit the Arctic context. The diverse and adaptable set of tools included in the Smart specialisation framework, and the networks and policy players supporting work on S3, can be of great assistance for tackling the multi-faceted challenges and future opportunities facing the Arctic regions.

The key findings of this report include the following:

- There has been considerable upgrading in regional planning processes in recent years. Nordic Arctic regions are preparing and updating regional smart specialisation strategies, and the advancement of sustainability issues through the implementation of these strategies is high on the Agenda of the Nordic Arctic area.
- The regions in North Finland, North Sweden, and North Norway are increasingly taking sustainability issues into account. Sustainable development has been embedded in the regional Smart specialisation strategies to some extent in all regions. All the regions are investing in green transition and sustainable development. Regions also use the SDGs as an integral part of their regional development and smart specialisation process. However, there is still considerable variation between regions in how the Smart specialisation concept is perceived and adopted, and in the level of integration of sustainability into Smart specialisation work.
- The embeddedness of sustainable development in smart specialisation in the Nordic Arctic has sparked a dialogue between key stakeholders on economic, social, and environmental sustainability and is already making fundamental changes to how regions are grounding and localising their S3 processes. The continuous emphasis on sustainability in the Nordic Arctic specifically addresses the questions of the sustainable use of Arctic natural resources in regional planning. Embedding sustainability challenges in smart specialisation adds an additional element to the already complex Smart specialisation framework. Extending the scope of S3 requires investment in high-quality communication and the mobilisation of local stakeholders, including indigenous Sami communities.

- The study highlights a number of state-of-the-art good practices as well as dilemmas in the Nordic Arctic, ranging from the regional attraction of huge industrial investments in green transition to the development of regional knowledge-platforms, and to initiatives to tangibly incorporate sustainability and SDGs issues to prioritised themes or sectors (e.g. linking to blue growth processes).
- Regional stakeholders view the threat of climate change as a moving target. It is important to ensure adaptability and resilience in sustainability policies and measures.
- The Russian aggression on Ukraine and its consequences place even more expectations on the Nordic Arctic region at EU and national level, both in terms of providing energy solutions, and in terms of challenging regional planning systems that are facing an influx of new activities.

The authors put forward the following recommendations for embedding sustainable development in Smart Specialisation in the Nordic Arctic regions:

- Within sustainability work, there is a clear need to ensure that Smart Specialisation is anchored comprehensively in and across the European Arctic regions. This is a prerequisite to the successful embeddedness of sustainable development in smart specialisation. The new challenges and tools relevant to the Smart specialisation concept need to be communicated in a clear and understandable way to stakeholders in European Arctic regions.
- Smart specialisation has received an extra boost via the SDG framework in the Arctic also. The widely recognised and legitimised SDG framework should be utilised in further developing sustainable Smart specialisation for the European Arctic regions.
- Further incentives would be welcome to harness the potential of embedding sustainable development in Smart specialisation, such as engaging indigenous populations in policy processes. Funding authorities play a key role in encouraging those concerned to propose and implement projects promoting sustainable development in Smart specialisation strategies.
- Flagship projects, testbeds and good practice cases are important in engaging stakeholders to further develop projects that embed sustainable development in Smart specialisation.
- Inclusive action is crucial in the Arctic. The emphasis should lie not only in the larger cities but also in unlocking the full potential of the more remote localities of each region. The flagship projects of big industries should be complemented by grassroot initiatives, e.g. activities undertaken by young people and people representing indigenous populations.
- Embedding sustainable development in Smart specialisation in the European Arctic would benefit from the expert help of organisations such as the EU JRC. The full utilisation of the ‘toolbox’ of policy methods embedded in Smart specialisation is recommended, including the guidance and support services offered by the JRC S3 Platform.
- One specific way of ensuring foresight and climate adaptation in smart specialisation strategies is to connect regional and local-level schemes in the European Arctic to the Mission on Adaptation to Climate Change as proposed for the Horizon Europe programming period.
- European Arctic regions should increase interregional and transnational cooperation in order to learn from other regions regarding both Smart specialisation and sustainable development. Mutual learning between the Nordic Arctic regions is highly recommended, especially as this may be a strategy towards a stronger, united response to common challenges, as for example, the growing demand for skilled labour arising from large-scale local investments in sustainable industry.
- Smart specialisation at regional level demonstrated a high level of resilience and adaptability in times of a pandemic without reducing the participation of local stakeholders in the planning

processes. Mobilisation of a variety of stakeholders is the key to success in enabling sustainable Smart specialisation.

- Smart specialisation is amenable to adaptation to changes caused by the consequences of the Russian invasion of Ukraine, as these are developments of high uncertainty that demand strategies worked out at and for the local level. It is also demonstrated that regional and broader innovation processes have received further encouragement following the need to meet the challenge of replacing Russian supply, for example in European energy strategies.
- Sustainable and inclusive Smart specialisation provides a great opportunity not only for the European Arctic, but also for the EU, in promoting recovery from the global pandemic.



## Introduction

The Arctic continues to attract increasing global policy attention. In the first instance, increased research and policy debate about how to empower sustainable development and industrial transitions is naturally crucial for European Arctic communities themselves. Moreover, it is recognised more and more often that these key questions for the Arctic are of global significance and are crucial to European-level considerations of sustainable development and strategic autonomy. Ambitions related to the sustainable future of European life and the realisation of the European Green Deal face a complex and mutually intertwined set of challenges and risks, hailing from the adverse impacts of climate change to insecurity in global markets and geopolitics. The Russian invasion on Ukraine and the continuing volatility particularly in energy markets, but also in tourism, have brought exacerbated security concerns to Europe's frontiers, complicating (and eliminating) many initiatives of inter-regional development collaboration in the European Arctic. All these considerations are crucially present in the Nordic Arctic regions, where Lapland (Finland) and Finnmark (Norway) have land borders with Russia.

The European Arctic comprises some of the most sparsely populated and peripherally located regions in Europe. While living standards and societal advancement in the European Arctic are high in global comparison, these regions are facing a systemic overhaul of the foundations of their economies and livelihoods. Furthermore, their peripheral status in relation to their national and European governing authorities places them in a vulnerable position that risks widening socioeconomic gaps vis-à-vis the European core. The European Arctic is no exception to the scientifically-proven pattern that the adverse effects of the climate crisis are most severe in vulnerable ecosystems and communities; the rise in temperature and the related impacts are already occurring at a faster rate and with more unsettling consequences in the Arctic than in Europe overall.

The European Arctic is being severely affected by several systemic transitions and threats at the same time: the adverse impacts of climate change; the challenges and socioeconomic costs of a sustainable transition of resource-intensive industry sectors; an unfavourable ageing demographic structure that risks weakening the dynamism of local economies, skills and labour markets; geopolitical and commercial pressure on resource exploitation and growing energy production; and threats to biodiversity and indigenous heritage.

The frameworks and policy processes at the forefront of the global sustainable development agenda feature a wide set of tools to empower progress in sparsely populated areas set in a frail natural environment, such as in the Arctic regions. However, the particular characteristics of these regions imply that these policy-processes ought to be tailored and applied context-sensitively in order to be effective. Indeed, there is a need to firmly anchor them in the general framework of regional planning and development strategy, as opposed to S3- and SDG-related policy processes being kept as separate and external to day-to-day development issues in the region.

This report provides a general analysis on how sustainability challenges and SDGs are included in ongoing S3 processes at regional level in the Arctic. The authors assessed a status quo with an overview in 2020, and two years later, in 2022, analysed how these processes have developed since 2020. The 2022 analysis has included an assessment of the impacts of the pandemic as well as of the Russian invasion of Ukraine.

The study has been guided by the following research questions:

- What characterises the development of regional Smart Specialisation policies in the Nordic Arctic regions?
- How can Smart specialisation strategies and the SDG framework be synthesised and thereby respond to Arctic challenges at regional level?
- What are the biggest opportunities and challenges for S3 to foster sustainability transitions towards the SDGs?
- What are the state-of-the-art good practices in the Arctic of how SDGs are included in Smart specialisation strategies
- How may Nordic Arctic efforts in S3 for SDGs be further facilitated and scaled up?

While the roll-out of Smart specialisation has successfully introduced a coordinated and harmonised way for a regionally-driven advancement of European innovative capacity, current policy priorities for Europe have inspired a widening of the ambition and scope of Smart specialisation. This policy is useful for driving the EU's overarching ambition of sustainability and for designing Smart specialisation strategies for sustainability and inclusiveness, wherein increasingly locally-driven smart specialisation processes integrate regional innovation policy with aims and measures to advance sustainable development and the SDGs. This wider and more developed future-focus on the smart specialisation agenda is inextricably connected with wider EU policy frameworks. The connection is crystallised particularly well in the broader focus within the European policy discourse on a Twin Transition: connecting and harmonising the needs and opportunities arising from the green, sustainability-focused transition with the trends and consequences surrounding the digital transition.

However, while the practical applicability of Smart specialisation for sustainable development strategies is evident, effort needs to be placed at angling the S3 process correctly and widening its participation, so that it may address substantive sustainability challenges. A recent report outlines key steps for this work, including the localising of SDG targets, the inclusion of more diverse stakeholders in S3 processes, and focusing S3 future scenarios, visions and priorities on finding new pathways to realise the sustainability transition (Miedzinski et al., 2022).

While they may not always be explicitly applied or perceived as such by regional stakeholders, both the SDGs and the Smart specialisation policy framework are built on core assumptions that align well with the complex and cross-cutting challenges facing the Arctic regions. The analyses and case-examples included in this report demonstrate how these holistic measures may be leveraged by Arctic regions, both in local communities and through interregional collaboration and policy initiatives, to meet the complex systemic challenges facing the European Arctic and contribute to innovation and sustainable development work on a globally significant level.

The key findings are particularly relevant in the context of informing the increased momentum of Horizon Europe and the European Green Deal, not to forget the strengthened and expanded instruments created as part of the European recovery effort from the onslaught and consequences of the COVID-19 pandemic. Moreover, regional and localised strategies and processes discussed in the report can play a key role in informing and legitimising top-level strategic frameworks relating to the Arctic. These include the EU's Arctic Policy, for which the most recently updated version emphasises the value of empowering sustainable regional development in European Arctic regions through Smart Specialisation (European Commission, 2021; Koivurova et al., 2021).

Finally, the policy recommendations put forward on the basis of this analysis may inform sustainable development policy-efforts in other vulnerable regions of the world, as well as amend the literature applying to Smart Specialisation as a toolbox in the development of Science, Technology and Innovation (STI) roadmaps for the SDGs.

## Methodology

The research and analysis presented in this report were conducted by the authors in the period 2019-2022 through a combination of qualitative, semi-structured interviews, and desk-based research using available statistical data, regional development reports, and Smart specialisation strategies at regional level. This report builds on the JRC technical report "Smart Specialisation in Sparsely Populated European Arctic Regions" (Teräs et al., 2018).

The respondents interviewed were selected on the basis of their local experience and knowledge about the regional and innovation policy processers in the Nordic Arctic regions. Some interview respondents are representatives of regional and county councils in the regions covered, while others are executives or programme managers for the country-specific case studies. In order to achieve a viable longitudinal research element, some key respondents were contacted twice during the research process, with the aim of capturing developments and updates taking place in the regions during the course of the second period of active research. To increase the reliability of data, the stakeholders interviewed were also given the opportunity to review and comment on the draft version of the regional chapters of the report ahead of its submission.

Lastly, prior to the official publication of the report, a workshop webinar session was convened on 12 December 2022, moderated by the EU JRC, to present the findings to regional stakeholders and experts, and to gather feedback and final editing comments for the final delivery.

# 1. The Arctic Context

## 1.1 Defining the European Arctic regions

The Arctic region consists of parts of Northern Russia, the American Arctic (Alaska and northern Canada), and the European Arctic (Greenland, Faroe Islands, Iceland, Arctic Finland, Arctic Norway, and Arctic Sweden). The Arctic region is traditionally characterised by a cold climate and sparse population. However, more recently the Arctic has gained particular attention as a part of the world prone to significant dynamism and volatility.

On the one hand, natural conditions in the Arctic region are particularly vulnerable to the climate crisis and face irreversible damage if the impacts of climate change are not addressed. On the other hand, the Arctic has become an active geopolitical playing field. Russian aggression in Ukraine has increased the geopolitical tension between Russia and the Arctic states, most clearly manifested with Finland and Sweden applying for membership of the North Atlantic Treaty Organisation (NATO) and the halt of co-operation with Russia in several forums and policy and funding programmes, including for example, Barents Euro-Arctic co-operation as well as Northern Dimension co-operation.

The analysis of the present report will focus on the Nordic Arctic regions, which make up the continental part of the European Arctic (see Figure 1). These regions are Finnmark and Nordland in Arctic Norway, Norrbotten and Västerbotten in Arctic Sweden, and Lapland in Arctic Finland.

Figure 1. The Nordic Arctic regions



Source: Nordregio

Table 1. The Arctic regions in figures

<b>Region</b>	<b>Population 2021*</b> (*NO: 1.1.2022, FI & SE: 31.12.2021)	<b>Unemployment rate 2021</b> (Labour Force Survey by NSIs)	<b>Regional GDP per capita 2019</b> (in USD, current price, current Purchasing Power Parity)	<b>Regional Innovation Scoreboard index</b> (2021 data on NUTS2 level)
Troms og Finnmark (NO)	241,736	3.8 (Nord-Norge)	53,907	Strong - (N007 Nord-Norge)
Nordland (NO)	240,190	3.8 (Nord-Norge)	51,832	Strong - (N007 Nord-Norge)
Norrbottnen (SE)	249,693	5.6	60,147	Strong+ (SE33 Övre Norrland)
Västerbotten (SE)	274,563	6.6	49,095	Strong+ (SE33 Övre Norrland)
Lapland (FI)	176,494	9.2	45,159	Strong+ (FID Pohjois- ja Itä-Suomi)

Source: National Statistics offices, OECD & European Commission Regional Innovation scoreboard

Table 1 summarises some key demographic and economic figures for the Nordic Arctic regions. In the equivalent time periods, the average unemployment rate in the EU area was between 6-8%, and the GDP per capita was circa 35,000 USD. The Nordic Arctic can thus be characterised as an economically strong region overall, with high capacity for knowledge-intensive innovation in a Europe-wide comparison. The growth in GDP per capita has been particularly strong in recent years due to an increase in large-scale industry investments, even though the COVID-19 pandemic has dampened the otherwise positive economic outlook of the Nordic Arctic region. This data also needs to be set against the geographical context of these regions which are located several hundred kilometres away from their countries' capital cities and financial centres. On the one hand, the economic performance and resilience of the regions despite their context is impressively strong. On the other hand, the sparse population numbers have an obvious effect on the high per-capita GDP figure compared to urban and metropolitan regions elsewhere in Europe.

## 1.2 Regional development in the European Arctic

The European Arctic shares many defining characteristics with the Arctic region at large: cold climate, sparse population, and wealth in natural resources. The increase in global interconnectedness has had a significant impact on European Arctic communities, their lifestyle and economic structure: Urbanisation, increased education levels and socio-economic structural transitions have given rise to large migration flows between the European Arctic (especially rural areas) and larger urban centres in the South (in particular the Nordic capitals) (Nordregio, 2016). Many young people are led to move out of the European Arctic in search of better education and job opportunities, while much of the in-migration is made up of a temporary or seasonal (predominantly male) workforce in the mining, tourism, and marine industries, for example. The exacerbation of the ageing population structure and gender imbalance as a consequence of these labour mobility trends makes societal development and maintenance of regional service economies increasingly challenging in many parts of the European Arctic (Ibid.).

*Table 2. Summary of main development opportunities and challenges in the European Arctic*

<b>Domain</b>	<b>Opportunities</b>	<b>Challenges</b>
<i>Social</i>	Increasing labour opportunities for mid- and highly skilled workers	Risk of one-sided economy that skews regional demographic curve; risk of undermining status of indigenous population
<i>Technical</i>	Advancements in technologies towards sustainable energy, industry and transport	Uncertainty about the trajectory of emerging technologies; slow rollout of sustainable transport links to improve accessibility and reduce travel times
<i>Economic</i>	Sustainability transition a significant opportunity for long-term regional economic stability	Lingering economic slowdown from pandemic recovery and other uncertainty in global markets
<i>Environmental</i>	Important natural resources for sustainability transition	Climate change brings radical environmental shifts
<i>Political</i>	Increased global focus on and interest in the Arctic regions	Geopolitical shifts caused by natural resource extraction and Finland and Sweden's NATO membership applications; halt to Russian collaboration after the invasion of Ukraine

A separate but particularly grave challenge is posed by the climate crisis. The Arctic is subject to larger than global-average temperature changes caused by global warming, which give rise to melting ice sheets and permafrost and a risk of significant biodiversity loss (NOAA, 2020). In fact, according to current estimates the Arctic has warmed nearly four times faster than Earth as a whole since 1979 (Rantanen et al., 2022). Coupled with the other large transition trends, the European Arctic is subsequently a very volatile and vulnerable region.

The circumpolar areas of Norway, Sweden and Finland are inhabited by the indigenous Sami peoples, whose traditional living environments and livelihoods are particularly vulnerable to several transition trends facing the European Arctic in recent times, climate change included. The cultural heritage as well as the autonomous legal, political and administrative rights of the Sami peoples are protected at global and national level. However, their particular vulnerability as a minority indigenous population is brought up frequently in regional and national policy debates concerning the entry of multinational companies, the development of infrastructure for the production of renewable energy such as windmills, and in regional industrial and transportation planning (Arctic Centre, 2018).

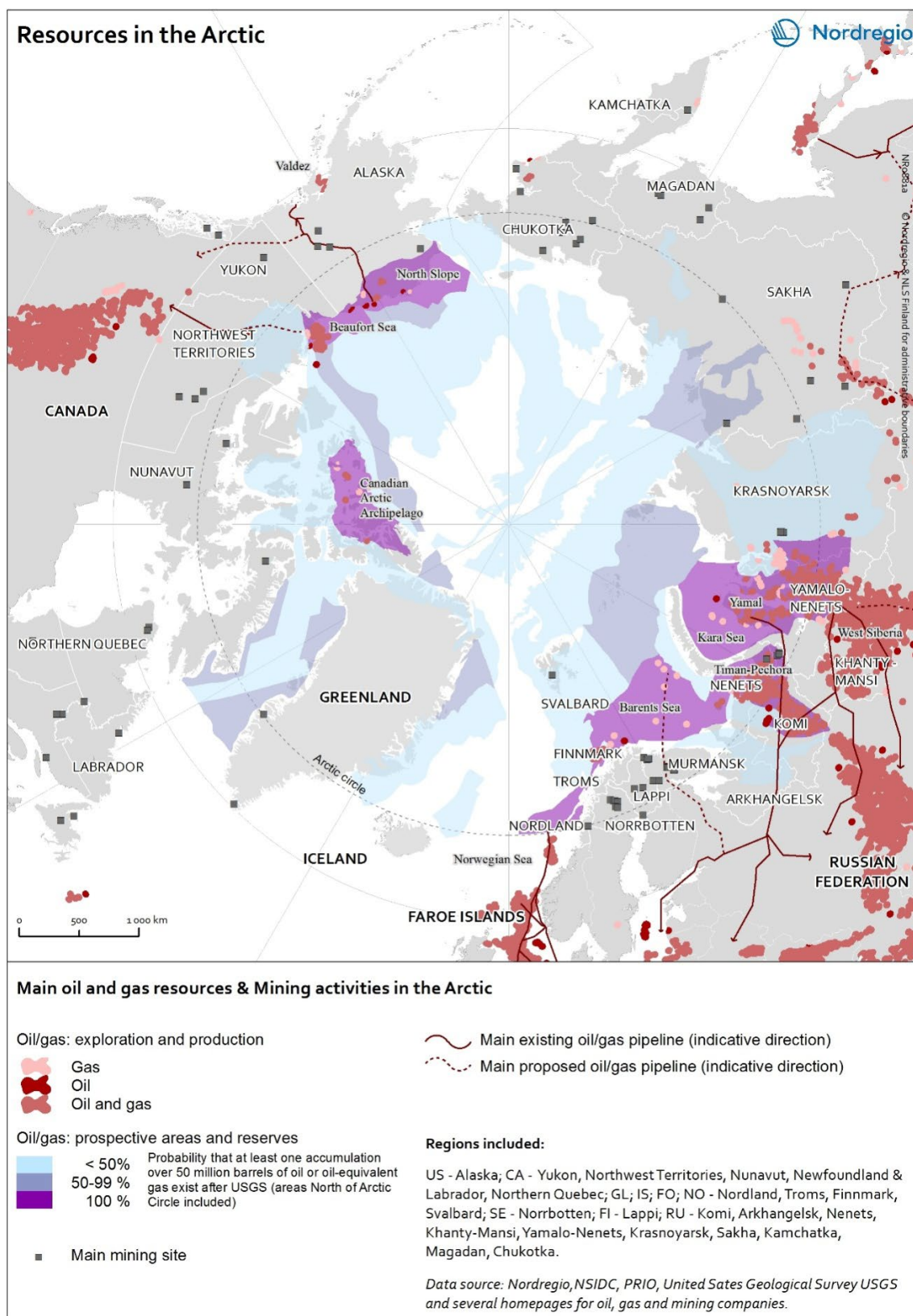
The most significant economic sectors in the European Arctic are resource-intensive extraction and refining industries for global exports, small-scale traditional production for local consumption and the tourism and experience sectors (Nymand Larsen and Fondahl, 2014). Oil and natural gas extraction are extensive in Norway and the Faroe Islands, but the energy sector in Norway has also made increasing efforts to prepare a phase-out of fossil fuels. Iceland and Norway have well-established aluminium production facilities. Moreover, the European Arctic has significant ore reserves, and mineral extraction is a key industry in Greenland and the geological region of the Fennoscandian Shield (Finland, Sweden, Norway). There are over 160 significant industrial mineral deposits of base metals, ferrous metals, gold, platinum metals, high-tech metals, industrial minerals, diamonds, etc. In recent years, approximately 90% of the European production of iron ore has come from Northern Sweden, and Finland accounts for a substantial share of the EU's production of gold, silver, zinc, and copper (Nordregio, 2016).

There is potential for establishing an even stronger global hub for sustainably sourced resources for future needs. This potential has been amplified not least by on-going projects to build 'gigafactories' for sustainable battery production in Nordic locations within and close to the European Arctic (European Commission, 2019). This battery factory trend is unofficially named the 'Nordic Battery Belt', and builds on the availability of minerals, skill-intensive industries that can host strong supply chains, and inexpensive and fully renewable energy production. A second key driver of the momentum for the Nordic Arctic as a sustainable industry transition hotspot is the breakthrough innovation towards emission-free steel production using hydrogen, currently undertaken by several stakeholders based around the iron ore and steel industry in Northern Sweden. World-leading ICT stakeholders have also recently established server stations and other facilities in several Nordic Arctic locations, benefiting from inexpensive cooling and renewable electricity supply.

Because of the long coastline and access to the sea, the marine sector and opportunities for blue growth are naturally central to Arctic communities in Iceland, Greenland, the Faroe Islands, and the Arctic regions of Norway. Sustainable marine energy and logistics are important growth areas for exports, especially given that freight traffic in many Arctic shipping passages was, until recently following the Russian invasion of Ukraine, steadily increasing. The marine-based bio-economy, in turn, mainly involves the food industry in the coastal areas of the European Arctic, as well as nature tourism and outdoor experiences such as deep-sea fishing and whale-watching. Small coastal communities in Norway and the Faroe Islands are particularly well suited for aquaculture because of their clean waters, remote location, comparatively high sea temperatures, and sheltered locations within long and deep fjords. Maintaining the sustainable fish stocks in Arctic waters may be challenging as the management of big Barents Sea fisheries are based on agreements and collaboration with Russia.



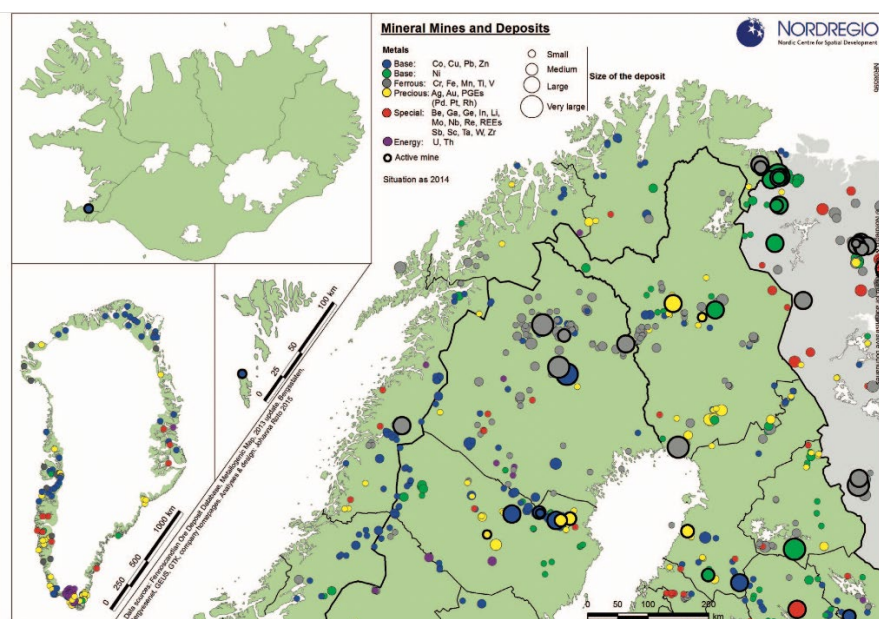
Figure 2. Resources in the Arctic Region



Source: Nordregio



Figure 3. Minerals and mines in the Nordic Arctic (source: Nordregio)



Source: Nordregio

The importance and potential of the Arctic land-based bio-economy is greater in the forest-rich Arctic regions of Sweden and Finland. While many other forms of agriculture are difficult to maintain due to the climate conditions, reindeer husbandry is a traditional economic activity that still has a large weight for the maintenance of some of the most remote Arctic communities. Reindeer husbandry is often linked to the Sámi indigenous population, and the Reindeer herding area, spanning from the highlands of Norwegian Oppland in the west to the east coast of Russia's Kola Peninsula in the east, covers a land area of over 500,000 square kilometres. In the Faroe Islands, Southern Greenland and Iceland, sheep farming constitutes a major part of the local economy (Arctic Centre, 2018).

The European Arctic comprises some of the most sparsely populated and peripherally located regions in Europe, which implies that regional development in the Arctic requires more focus and effort than in regions closer to key urban centres and economic hotspots (Nyman Larsen and Fondahl, 2014). On average, regional economic diversification in the European Arctic is lower than in less remote Nordic regions, This has given rise to a high dependence on public-sector support from the Nordic capitals and other funding sources to maintain service sectors that are vital for guaranteeing equal opportunities and living conditions in the European Arctic (Nyman Larsen and Fondahl, 2014).

The vulnerability of European Arctic communities is exacerbated by their dependence on industrial sectors that are facing inevitable transitions to a more sustainable future. In other words, while living standards and societal advancement in the European Arctic are high in global comparison, these regions are facing a systemic overhaul of the basis of their economies and livelihoods. Moreover, their peripheral status in relation to their national and European governing authorities places them in a vulnerable position that risks broader socioeconomic gaps vis-à-vis the European core.

The European Arctic economies are heavily built around sectors dependent on demand from global resource-intensive industries and winter tourism. While the wider economy of the Nordic Region is also characterised by export industries, the relative lack of diversity in the number of strong sectors

and stakeholders in the Nordic Arctic make these Northern areas even more vulnerable to economic shocks and protracted downturns. The extent of the consequences brought on by the COVID-19 pandemic and related economic depression is yet to be fully understood, but it is already clear that prolonged border closures, the eradication of vibrant tourism flows, and a dramatic decrease in global manufacturing demand, have brought on a historically grave and multi-faceted threat to the survival of the Arctic regional communities and their continued sustainable development.

Moreover, the European Arctic is no exception to the scientifically-proven pattern that the adverse effects of the climate crisis are most severe in vulnerable ecosystems and communities: The temperature increase and related impacts are already faster and more unsettling in the Arctic than in Europe overall (NOAA, 2020; Rantanen et al., 2022). In order to avoid vicious circles that make the future sustainability of European Arctic communities even more uncertain and vulnerable, there is clearly a need for a context-sensitive Arctic sustainability discourse, in line with the SDG-commitment to reach the most vulnerable areas first.

These challenges to the resilience of the Nordic Arctic regions have been amplified even more by Russia's invasion of Ukraine. As described above, the Russian armed action against Ukraine has caused formidable challenges to international co-operation with Russia, and has already changed the security architecture of the Nordic Arctic region, in particular Finland and Sweden's NATO membership applications. Another set of immediate implications for the Nordic Arctic is that there is a need for increased energy production within Europe in order to enable decoupling from Russia in the longer term. In the short term, this means intensifying the use of existing energy sources (e.g. stronger reliance on oil and gas from Norway or by utilising peat in Finland). The current crisis will, in the longer term, shift the emphasis towards energy efficiency and renewable energy.

More importantly, the need to cut dependence on Russia results in pressure to accelerate the sustainability transition, not only on the grounds of climate and energy policy but also due to the security of supply and overall security considerations. This places a spotlight on the Nordic Arctic to produce more minerals, metals and energy (wind power, hydrogen etc.), as well as to invest in R&D and innovation in these industries. The demand for minerals and metals will likely further increase the growth and prominence of regional hubs and policy priority areas in sustainable mining and other resource-intensive industries. In addition, research and innovation in marine mining may well increase, given the need for critical minerals. These activities (that are in themselves controversial) need to be undertaken equitably and with local collaboration and dialogue to avoid developments akin to 'green colonialism' in the Arctic regions.

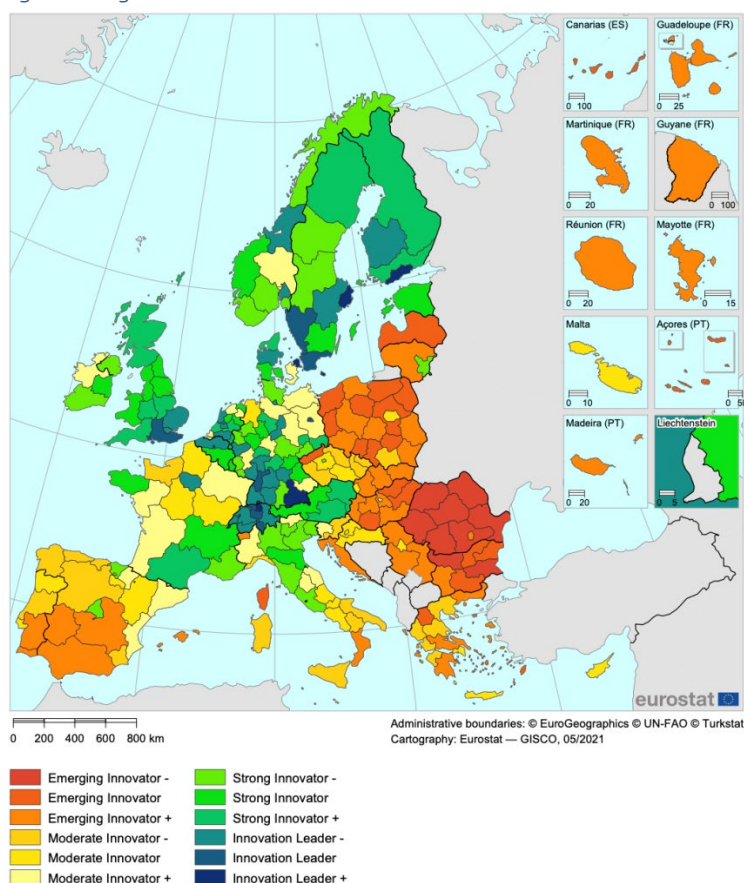
Nordic Arctic regions have demonstrated an encouraging and creative drive for regional reinvention and resilience, whereby stakeholders work together closely to develop new focus-areas for entrepreneurship and innovation (European Commission, 2019). As we write, the economic and social resilience, as well as resilience related to geopolitics, is being put to the test in Nordic Arctic regions, also due to the Covid-19 pandemic and the consequences of the Russian invasion to Ukraine.

Some emerging areas of activity may be entirely new to the region, but many new domains also build on and reinvent traditional industry-specialisations to align with emerging trends in the global green and digital transitions, such as digitalisation, automation, carbon-neutrality, and the sustainable use of natural resources. In addition to encouraging diversification in available sources of livelihood for the Arctic regions, these developments are often specifically aimed at improving the environment and

quality of life of the local communities where they are created. Some of the most prominent examples of these innovative industry-initiatives are found in the areas of bio-economy, sustainable tourism, production and use of sustainable energy forms, circular economy, sustainable process industries and high-technological research, and blue growth.

These and related dimensions of regional development in Arctic conditions have inspired collaborative dialogue and development projects to be undertaken among Northern Sparsely Populated Areas (NSPA) – regions that share similar characteristics and trajectories in the face of future challenges and transitions. The NSPA Network is an informal, OECD-affiliated association linking together 14 Nordic regions (including all the regions on which the present report focuses). The collaborative network was formed in 2004 and maintains close interaction with policy stakeholders in Brussels and Northern Europe over the policy issues and transition trends that concern the Arctic regions. Recent activities have included discussing, distributing and following up on the findings of the OECD (2017) Territorial Review on NSPA, deliberating on the EU’s new Arctic Policy (European Commission, 2021) and long-term budget proposals, as well as advancing discussion on circular economy best-practices to enable sustainable transitions in Arctic industries. The following chapters place the policy and practice of sustainable development of the Nordic Arctic regions in the context of the 2030 Agenda (Chapter 2) and Smart Specialisation (Chapter 3).

Figure 4. Regional Innovation Scoreboard 2021



Source: European Commission

## 2. Sustainable Development and the European Arctic

### 2.1 The Sustainable Development Goals and the European Green Deal

The 2030 Agenda for Sustainable Development was adopted in 2015 by all Member States of the United Nations and represents an ambitious and coordinated commitment to realise social, economic and environmental development to benefit all of humanity. On the one hand, the ambition of the 2030 Agenda is to support global development as comprehensively and equitably as possible, pledging to ‘leave no-one behind’ and ‘reach the furthest behind first’ (United Nations, 2020). Compared to the preceding UN sustainable development agenda that was divided into eight Millennium Development Goals, the current efforts are represented by 17 Sustainable Development Goals (SDGs), sub-divided into a total of 169 specific targets to be reached in milestone years or at the expiration of the development agenda in 2030. The SDGs collectively emphasise and guide efforts in both a wide range of social, economic and environmental functional domains, as well as crucial overarching themes such as efficient governance and partnership building. The SDGs are thereby versatile enough to remain relevant to and comprise the key development challenges and opportunities for each region and community in the world. This allows global policy and research bodies to engage directly with the issues that are most pressing at local level.

On the other hand, the SDGs are also inherently interconnected and intended to be engaged holistically, applying measures that enhance synergies between different areas of development and minimise trade-offs (such as the risk for detrimental trade-offs between economic growth and environmental protection). The importance of comprehensive measures was emphasised in the 2019 Global Sustainable Development Report (GSDR), a science-driven guiding framework for SDG activities, presented by an independent group of expert-scientists based on available research and evaluations on SDG progress. The GSDR highlighted six particularly promising *entry points*<sup>1</sup> for action on the SDGs, as well as four powerful *levers*<sup>2</sup>, which are crucial for boosting local-level efforts and ensuring long-term progress (UN Independent Group of Scientists, 2019). The framework of levers and entry-points demonstrates how even activities that are seemingly narrowly connected to one specific goal or target will feature overlaps with other targets. Subsequently, system-level collaborations across sectors and functional areas carry significant potential to multiply the effect of individual stakeholders and activities at local level.

Other global-level frameworks that support particular aspects of delivering on the SDGs include (but are not limited to) the Small Island Developing States Accelerated Modalities for Action (the SAMOA Pathway), which supports measures tailored to some of the most vulnerable island communities; the UN Science, Technology and Innovation (STI) Forum, which encourages knowledge-sharing on how technological innovation can accelerate reaching the SDG targets; as well as a strong climate action discourse within and around the Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC).

<sup>1</sup> The six entry-points are Human well-being and capabilities; Sustainable and just economies; Food systems and nutrition patterns; Energy decarbonisation and universal access; Urban and peri-urban development; and Global environmental commons.

<sup>2</sup>The four levers are Governance; Economy and finance; Individual and collective action; and Science and technology.



Figure 5. Sustainable Development Goals



Source: United Nations

Figure 6. Key components of the European Green Deal



Source: European Commission

The most transformative EU commitment to the SDGs to date is through the European Green Deal (EGD). The EGD is the framework agenda on a comprehensive green transition and climate neutrality in the European Union by the year 2050, presented by the European Commission in 2019 (European Commission, 2019a). The ambitious agenda pledges that over the next decade more than 1.8 trillion EUR in investments, of which at least 30% will be channelled towards the implementation of the sustainable transition, drawing on innovation and using instruments such as Horizon Europe. Areas that receive particular attention in the EGD communication and policies include the energy-efficiency of industry and infrastructure, development and adoption of renewable and low-emission fuels and energy sources, circular economy, sustainable food production, and pollution reduction.

The momentum of the EGD as a defining framework for EU policy priorities was strengthened in 2020 in connection with the COVID-19 recovery plan, 'Europe's Moment', which places the Green Deal as the centrepiece of economic stimulus initiatives (European Commission, 2020). A 'Renovation wave' initiative has been announced to increase the energy-efficiency of buildings, and several policy-initiatives have been introduced to speed up the rollout and uptake of alternative fuels and renewable energy production. The 750 billion EUR recovery package, Next Generation EU, offers a significant funding boost to the EGD and its priority areas. Increased funds have also been pledged to the Just Transition Fund instrument, which pursues equal progress in green transition across Europe through increased support to the regions furthest behind, such as those heavily dependent on fossil-based industrial production.

## 2.2 Placing the EGD and SDGs in the Arctic context

The European Arctic, with the challenges to and opportunities for its development as summarised in the previous chapter, represents a regional context that epitomises the potential and necessity for the holistic sustainable development outlook envisioned by the SDGs and the EGD. As highlighted in earlier chapters, all pressing issues related to the development of European Arctic communities are linked to the climate crisis. Climate change affects the Arctic ecosystems and human activity in the Arctic region more adversely than in many other regions in Europe and the world, therefore risking an increase in the development gap. The vulnerability caused by the relative lack of economic diversity in Arctic regions further adds to these gaps.

Increased support of the most vulnerable and least developed areas in the Arctic region to strategically ensure progress towards the EGD objectives may create an opportunity for Arctic stakeholders to showcase their communities and receive support for their development. The argument for increased support from mechanisms such as the Just Transition Fund may be exacerbated by the adverse impact of recent border closures due to the COVID-19 pandemic, as the European Arctic is a region where uninhibited cross-border mobility and collaboration has been an inherent part of life throughout history.

The initiatives taken by stakeholders in extreme Arctic conditions may be important good-practice cases for other regions in Europe on how significant and interconnected climate and socioeconomic threats can be managed despite long distances and population scarcity. Many of the Europe-wide priority-areas of the EGD, such as alternative fuels and renewable energy; energy efficiency of industry and built infrastructure; circular economy; bioeconomy; etc., are already key priorities for European Arctic regions for their future livelihoods and environmental protection. Moreover, many of the critical climate-related changes are physically taking place in and around the Arctic regions, which is already turning the focus in many issue-areas to a potential future Arctic presence (resources, shipping lanes, etc.). For this development, it is wholly relevant, for example, in connection to the updated EU Arctic Policy framework and priorities, to examine and learn from the stakeholders who are already present and from their efforts to holistically ensure the sustainability of their environment.

The recent global geopolitical and economic trends have strengthened the commitment of the EU to increased European strategic autonomy in societal, economic, environmental, and geopolitical terms. From this perspective, sustainable development and innovation in the Nordic Arctic regions are a frontline priority for Europe's future competitiveness as a leader in sustainable innovation. An

indicative example of this commitment is the EU-level strategic engagement with sustainable raw materials and, for example, value-chains for sustainable battery production being built in the Nordic Arctic regions. More analysis and engagement with local-level policy initiatives serves to inform and strengthen this top-level strategic commitment, and vice versa.

A further overarching parallel that aligns the SDG framework particularly close to the European Arctic context and conditions is the focus of the former on holistic, cross-issue activities that seek to achieve systemic and long-term impact. The European Arctic is being affected by several systemic transitions and threats at the same time: The adverse impacts of climate change; the challenges and socioeconomic costs of a sustainable transition of resource-intensive industry sectors; an unfavourable, ageing demographic structure that risks weakening the dynamism of local economies, skills and labour markets; geopolitical and commercial pressure on resource exploitation; and existential threats to biodiversity and indigenous cultural heritage. As confirmed by the findings of the GSDR conclusions, it is evident that the greatest opportunities and synergy-benefits from activities in these issue-areas will be reached by linking the resources and momentum of local measures together across different SDG domains, instead of becoming trapped in silo thinking and building future development on isolated initiatives (UN Independent Group of Scientists, 2019). While this approach is endorsed globally, its message is particularly crucial in the sparse Arctic conditions where single sectors find it very difficult to form a critical mass around innovative projects and the distance to same-sector peers is much further than elsewhere.

At the same time, the Arctic regions may have a crucial role to play as an enabler for sustainable industrial transitions and climate-neutral technological advancement worldwide. Given their existing industries and competence in raw materials and heavy process industries, in the past few years there has already been an increasing momentum of both public and private investment in sizeable bioeconomy, green energy, and sustainable raw material industry innovations. Given the global importance of the Arctic regions in the fight against climate change and of sustainable materials and technologies for the future of several industries, the sustainable development measures taken in the European Arctic have worldwide significance. The following chapters of this report will draw on empirical analysis and best-practice cases to make recommendations on the most important progress-domains and areas for improvement, as well as how best to support these developments from a European and global perspective. Particular emphasis will be placed on the tools provided by the smart specialisation framework and on the additional momentum afforded by the European Green Deal.

## 3. Smart Specialisation for sustainable development in the European Arctic

### 3.1 Smart specialisation in the Arctic

The latest revision of the EU Arctic Policy places specific emphasis on the role of Smart specialisation (see Figure 7) as an important policy tool for innovation policy and strengthening the capacity and resilience of the European Arctic societies and economies (European Commission, 2021). The specific conditions of the Arctic regions mean that policy processes require significantly different implementation mechanisms to fit the Arctic context. The diverse and adaptable set of tools included in the Smart specialisation framework, and the networks and policy players supporting work on S3, can be of great assistance for tackling the multi-faceted challenges and future opportunities facing the Arctic regions. This sub-section summarises existing work that surveys S3 processes taking place specifically in the Nordic Arctic context.

Teräs et al. (2018) emphasise the potential to tailor smart specialisation to the specific opportunities and challenges of the Arctic conditions through: interregional collaboration to leverage skill-intensive capacity and critical mass; focus on the potential of sustainable development in the unique Arctic natural environment; and identification and support of existing platforms and networks in the area. They underline that the closely-knit collaborative networks characterising the Arctic regions can foster sustainable future growth. However, the authors stress the importance of substantive investment in innovative solutions for transitions in capital-sparse regions noting that more attention needs to be paid to the large disparities in the development of innovative clusters and knowledge-intensive economies within and between the Nordic Arctic regions.

The OECD Territorial Review report on Northern Sparsely Populated Areas (NSPA) (2017) contains similar findings. The NSPA Network is an informal, OECD-affiliated association linking together 14 Nordic regions (including all those in focus in this report) in collaborative dialogue and development projects. The report highlights smart specialisation as a valuable toolbox for growth and sustainability in the NSPA area, and argues for tailored approaches that go beyond merely enabling formal research and knowledge-intensive industries. The report recommends a closer focus of smart specialisation on 'areas of absolute advantage' based on local know-how about adapting to the Arctic environment (for example, cold weather testing, sustainable mining and forestry, etc.). Further recommendations (see Box 2) include increased representation of the NSPA area and its unique conditions at interregional and transnational policy fora; enhanced cooperation in strategic measures, e.g. by linking support for Sámi communities to other ambitions in regional and rural development; and strengthened governance mechanisms to facilitate the collaboration between governments and NSPA regions.

Similar findings were made by a JRC Working Paper by Teräs et al. (2015) on the operationalisation of Smart specialisation in sparsely populated areas (SPA) across Europe. The report findings emphasise that SPA are not lagging behind by definition, and that they demonstrate significant potential for innovation-driven growth and sustainable development. However, the specific contextual features of the regions, such as their narrow economic diversification, dependence on natural resources, and challenges related to skilled workforce retention, need to be carefully evaluated and mitigated through strategic alignment of policies and funding platforms.



### Box 1. Smart Specialisation strategies

Smart Specialisation Strategies (S3) are regional innovation strategies developed to contribute to a more effective use of Cohesion Funds in the 2014-2020 programming period. The concept emerged from the work of the High-Level Expert Group 'Knowledge for Growth', reporting to Janez Potocnik, EU Commissioner for Science and Research (Foray & Van Ark, 2008). As is also described in the Barca report in 2009, the Smart specialisation framework was introduced in order to boost innovation-led growth, nurture the competitiveness of European productive sectors, and reduce gaps between regions, building on the comparative advantages of regions and places across Europe. Smart specialisation became an ex-ante conditionality whereby the design of S3 was a prerequisite to access the European Structural and Investment Funds devoted to research, technological development and innovation, and maintained for the 2021-2027 period as a so-called enabling condition.

Smart specialisation is by design a place-based framework, which seeks to optimise investment and reform efforts in alignment with the specific industry domains and skills-specialities identified by regional stakeholders as carrying significant comparative advantage potential. Regional innovation-based specialisation and differentiation are viewed as two sides of the same coin, as both bolster economic development in a region, and each region is encouraged to engage in a comprehensive learning process to identify new combinations between region-specific capacity and region-specific opportunity (Foray, Morgan and Radosevic, 2017; Boschma, 2014). S3 aims at focusing R&I efforts on a limited number of priorities. Prioritised policy domains may involve wider socio-economic systems than traditional industry sectors, and the concept is therefore by design encouraging horizontal learning and cross-silo thinking. The process of identifying domains to be prioritised in a regional strategy is known as the Entrepreneurial Discovery Process (EDP), wherein regional policy officials engage with all relevant regional stakeholders for input and coordinate collaborative policy workshop exercises to produce a set of priority domains for the regional strategy. S3 has promoted a systematic stepwise approach to developing regional innovation strategies.



Source: PRI Playbook

Smart specialisation strategies provide regions with a benchmark and platform for enhanced interregional and transnational collaboration, not least within the EU's macro-regional collaborative areas. Many of the existing knowledge-exchanges and collaborative projects on Smart specialisation are supported by the European Commission, specifically by the JRC S3 platform. This platform also stimulates and produces research on Smart specialisation and related policy and innovation topics. Given the growing collaborative engagement, and scientific and policy rigour around Smart specialisation, many non-EU affiliated regions and countries in Europe and beyond have decided to develop their own processes and strategies and share them in the on-going policy collaboration.

More information: <https://s3platform.jrc.ec.europa.eu/home>

*Box 2. Key conclusions of the OECD NSPA Report*

NSPA-wide

- Establishing an agreed work programme amongst the NSPA regions which is integrated with national government decision-making and addresses shared opportunities and challenges such as improving east-west transport connections, reducing occupational and skills barriers to labour mobility, addressing barriers to business growth such as access to finance, and increasing the use of e-technologies in service delivery.

At national level

- Strengthen mechanisms to better tailor and integrate national sectoral policies with the particular needs and circumstances of NSPA regions, particularly for skills, innovation, trade and industry, and transport and digital infrastructure. In the cases of Finland and Sweden this also includes strengthening the role of the new regional autonomous bodies and county councils in co-ordinating national and EU regional and rural policy funds on a regional scale.

At regional level

- Add value to absolute advantages through better engagement with small and medium-sized enterprises (SMEs) via innovation and business support programmes and through regional co-operation to maximise the benefit of relatively small research and innovation assets.
- Improve connectivity to markets through continued investment in broadband as well as stronger east-west linkages to create competition with predominantly north-south infrastructure connections.
- Strengthen labour market and service delivery efficiency through better skills matching with employer needs and through strategies to concentrate population and resources in a smaller number of urban centres. (Delivering on these policy recommendations will depend upon proactive leadership and continuing to strengthen joint action by NSPA regions, with EU and national government partners.)

Source: OECD (2017)

Other research contributions to territorial and place-based entrepreneurial discovery and innovation policy processes include a theoretical framing by Dubois et al. (2017), which highlights the importance of natural environments and resources, civil society stakeholders, and advancements in physical and digital connectivity, as important dimensions contributing to sustainable regional diversification. Empirical cases studied from this perspective include, for example, Ylinenpää et al. (2016) tracing how a specific set of activities have stimulated regional development and innovation in Oulu in Northern Ostrobothnia, Finland, and Luleå in Norrbotten, Sweden. Teräs and Mäenpää (2016) analyse two S3 implementation processes, in the Finnish regions of Ostrobothnia and Lapland. For several years, Lapland and Nordland have been viewed as trailblazers in Smart specialisation implementation and scale-up, both in their vision and in the strategic implementation. As a result, they have become innovative regions known for their early implementation of regional innovation strategies, active involvement in European collaboration of S3, and close collaborations with other European regions in the development of S3 strategies.

## 3.2 Addressing sustainability challenges in S3 in the Arctic

The overarching ambition of a more sustainable and inclusive Europe has triggered a further refinement of the Smart specialisation concept and its constituent policy tools (European Commission, 2020a). Starting from bottom-up energy and local entrepreneurship, the S3 framework values assets that are embedded at regional and local level, both in planning, implementation and evaluation practices. This existing framework can therefore be a powerful tool to enable local implementation of the EGD and the SDGs.

Recent JRC reports reflect on how to align S3 strategies and policy processes with the SDGs (Nakicenovic et al. 2020, Miedzinski et al., 2021, Miedzinski et al., 2022). The conclusions provide a wide-ranging framework for aligning work on the key elements of Smart specialisation – diagnosis, governance, vision, Entrepreneurial Discovery Process, action plan and policy mix, and monitoring and evaluation – with policy goals linked to the SDGs. Key areas where the alignment of the two frameworks can be fostered include the localising of SDG targets in the regional context, the inclusion of diverse stakeholders in S3 processes, and focusing S3 future scenarios, visions and priorities on finding new pathways to realise the sustainability transition (Miedzinski et al., 2022).

This widened focus is connected with the wider EU policy frameworks. The S3 processes in European regions can leverage and support the implementation of the EGD and its constituent policy ambitions. In the field of research and innovation, the new Horizon Europe programme and the new Cohesion policy framework all contribute to an innovation-driven policy (European Commission, 2020). The potential added value from using the S3 strategic policy lens to engage regional stakeholders in the implementation can help regions to benefit from the large investment mobilised in the EU Recovery Plan, which emphasises, for example, energy efficiency, sustainable energy and industrial transitions.

There is a clear opportunity to create synergies between key tenets of S3 and sustainable development frameworks in the Arctic. On the one hand, the rationale of S3 specifically aiming at integration with SDGs is relatively new, and local stakeholders in the Arctic regions may not automatically perceive the Smart specialisation processes as a tool for achieving sustainability goals (at least not as a central objective). But on the other hand, based on hitherto conducted research and policy processes, the Nordic Arctic regions demonstrate clear potential that speaks in favour of making the specific and explicit connection from S3 to sustainability transitions and the SDGs more strongly. This can be achieved by linking processes, policies and measures at local level, both in the activities undertaken to strengthen innovation and networking, and in future strategies and visions being devised in regional centres. This proposition is based both on the interconnected nature of the specific challenges and transition-trends facing the Arctic communities, and on the finding that core sustainability aims and values have de facto already been embedded in Smart specialisation and innovation-driven economic development policy and practice in Nordic Arctic regions for many years (Teräs et al., 2018). The following paragraphs expand on the key synergy benefits from increased interconnectedness of Smart specialisation and sustainable development in the European Arctic.

### Box 3. Smart specialisation for the SDGs

Smart Specialisation for Sustainable Development Goals (S3 for SDGs) is an approach that aims to integrate sustainability orientation and Sustainable Development Goals (SDGs) in the policy cycle of Smart specialisation strategies from their design to implementation, monitoring and evaluation. The underlying idea of S3 for SDGs is that science, technology and innovation can be mobilised to address societal and environmental challenges. S3 for SDGs allows the localisation of global challenges making them meaningful for different territorial contexts and local communities. This is the basis for the mobilisation of new stakeholder coalitions and innovations for sustainable development.

JRC has proposed a theoretical and conceptual framework for S3 aligned with the SDGs. The framework draws on a comprehensive review of academic literature on sustainability transitions. The main conclusion from the review is that while the current approach to S3 has a lot to offer to foster transitions (e.g. participatory governance and discovery process, central role of innovation, place-based approach), it needs to be revisited and extended if it is to facilitate reflexive, responsible innovation and systemic change in line with the transformative ambition of the 2030 Agenda. The framework includes three overarching characteristics that can give S3 a stronger sense of direction for the future:

- Shared direction towards the SDGs: S3 can be guided by the SDGs as an overarching direction of transformative change. SDGs can provide strategic framing for regional visions and for the selection of key priorities at different territorial levels. The S3 process, in turn, could help in localising the SDGs and mobilising science, technology and broadly understood innovation to address these challenges in specific territorial contexts.
- Whole-system transformation towards sustainability: S3 design calls for creating synergies and consistency with other policies, both horizontally and vertically, in order to drive structural and systemic change. To address sustainability challenges, this focus needs to be extended to reflect and foster wider socio-technical system transitions needed to tackle sustainability challenges. The S3 process helps to clearly identify specific areas and niches where the community of stakeholders can meaningfully act and achieve change while contributing to wider systemic transformations.
- Responsibility and reflexivity: S3 can integrate moral and ethical considerations and discussions needed to navigate difficult transition choices, which balance creating and capturing value for the region with contributing to the tackling of wider environmental and social challenges. Policy learning capacity is needed to identify and foster synergies and to openly discuss trade-offs and limitations. This is important for harnessing the potential of S3 to work towards 'just transitions' that leave no one behind and create shared value for future generations.

These characteristics have significant implications for the original design of Smart specialisation. SDGs as a framework imply a deeper reflection on the motivations and rules guiding territorial competitiveness and comparative advantage. It is crucial that the reflection and design of Smart specialisation explicitly considers the challenges of the growing innovation divide in Europe, within countries and regions. The divide may grow larger because of the lack of capabilities for addressing sustainability challenges in territories with lower institutional capacity. The revised approach - adaptable to different contexts and open to different types of innovation - may be an important policy instrument for tackling this challenge and helping leave no place behind. The S3 for SDGs approach is one of the tools featured in the Partnerships for Regional Innovation (PRI) – a new experimental approach to place-based innovation policy, which builds on experience of S3. The framework is included in the "PRI Playbook" developed by the JRC with the support of a Scientific Committee of recognised experts.

Sources: Nakicenovic et al (2020), Miedzinski et al (2021), Miedzinski et al (2022)

Further information on PRI: <https://s3platform.jrc.ec.europa.eu/pri-playbook>

There is strong research consensus demonstrating the centrality of the unique Arctic climate, natural resources, sparse environmental and societal conditions in the development of Smart specialisation strategies. In other words, the focus of Smart specialisation in the Arctic regions lies inherently with the fundamental pillars of locally-driven action in support of the sustainable development framework. Likewise, the importance of breaking away from narrow sector-specific silos is interwoven in the essence of both frameworks and in the policy guidelines they inspire. While at first glance it may appear that the holistic and comprehensive development approach endorsed through the SDGs is at odds with finding and spearheading Smart specialisation domains for Arctic regions, it is notable that the policy research findings surrounding Smart specialisation implementation in SPA and Arctic contexts specifically emphasise industry *diversification* as a key objective. Therefore, Arctic S3 processes to date are not to be understood as favouring narrow industrial champion projects, but as promoting new horizontal and interregional collaborations to broaden and diversify the innovative dynamic of local economies and to effectively localise the SDG targets (Miedzinski et al., 2022).

The centrality of the Arctic region as a hotspot for many global systemic transitions is a relevant issue for policy stakeholders in Europe and beyond. Arctic cooperation with European regions and support mechanisms may well be significantly boosted by an analytical combination of active Smart specialisation focuses and sustainability-informed policies and initiatives. This is especially salient given the strong sustainability and resilience focus of the Horizon Europe policy framework and the EGD, the pledge and policy momentum which has been further strengthened by the Covid-19 pandemic recovery fund and is visible, for example, as a strengthening of the Just Transition Fund in its support of vulnerable communities. Recent work on aligning S3 and the SDGs particularly stresses the inclusion of wider participant groups, in particular civil society, into the S3 process (Miedzinski et al., 2022). This form of closer alignment of general innovation policy goals with SDGs is particularly clear when looking at the closely-knit inter-sectoral networks prevalent in the sparsely populated Nordic Arctic regions.

A sustainable development focus brings a more substantive urgency and context to the Smart specialisation policy framework and processes, and this infusion comes very naturally to the Arctic regional context where innovation and regional competitiveness already gravitates around sustainability related innovation and economic activity. SDG-linked projects and platforms in the Nordic Arctic gain a powerful ally in the S3 framework, and there will be particular focus on enabling the existing knowledge-intensive research hubs in the Arctic to mobilise diverse community-led efforts even more, including in rural areas. To channel holistic SDG processes through Smart specialisation domains may well strengthen the sustainable development engagement of the Nordic Arctic regions that have already developed closely-knit Smart specialisation networks and locally-driven entrepreneurial discovery processes. This is also supported by a recent policy report by McCann and Soete (2020:17), finding that “Smart Specialisation in the context of the European Green Deal provides a unique combination of both top-down macro-level directionality and widespread bottom-up micro-level and business-led engagement which ensures that the creative energies of Europe can be targeted and focused on medium- and long-term Green Deal goals”.

The present report is written to portray local and regional perspectives from the Arctic, contributing to the growing global policy research agenda that seeks to identify how STI policy and practice can be strategically leveraged to achieve the SDGs. In this discourse, the focus on innovation and Smart specialisation is treated partly as a means to an end instead of an ultimate policy goal. This implies

that the planning and implementation of regional innovation policy should be strongly linked to the SDGs and localised sustainability-centred platform.

The policy agenda for connecting these two dimensions of policy frameworks is motivated by a vision of wide-reaching benefit and positive synergy: both for sustainable development policy, as it becomes more intertwined with strong policy action in favour of prosperity and technological advancement; as well as for STI policy (including Smart specialisation), as these are placed in a wider sustainable development context that gives them a stronger ‘purpose’ and sense of urgency than they would have on their own simply as market-enhancing policies.

The focus on STI policy frameworks in support of the SDGs has become a widely recognised policy agenda in several global development settings, and engaged stakeholders push this dialogue further in contexts such as the UN STI Forum. The EU JRC has been actively involved in the global discussion about developing STI roadmaps for SDGs, in particular because Smart specialisation has been identified as a useful and applicable policy framework in this regard. JRC has undertaken one of five global pilot projects for developing new STI roadmaps for SDGs, with a country case in Serbia (European Commission, 2020b). The work is done as part of the UN Technology Facilitation Mechanism (TFM) and coordinated by the Inter-Agency Task Team on STI roadmaps to achieve the SDGs, of which JRC is a contributing member. This and other work also feeds into recent theoretical contributions of “S3 for SDGs” (Miedzinski et al., 2022).

On the one hand, the rationale of S3 specifically aiming at integration with SDGs is relatively new, and local stakeholders in the Arctic regions may not automatically perceive the Smart specialisation processes as a tool for achieving macro-level environmental policy goals (at least not as a central goal). But on the other hand, based on hitherto conducted research and policy processes, the Nordic Arctic regions demonstrate clear potential that speaks in favour of making the specific and explicit connection from S3 to sustainability transitions and the SDGs more strongly, by linking processes, policies and measures at local level, both in the activities undertaken to strengthen innovation and networking, and in future strategies and visions being devised in regional centres. This proposition is based both on the interconnected nature of the specific challenges and transition-trends facing the Arctic communities, and on the finding that core sustainability aims and values have de facto already been embedded in Smart specialisation and innovation-driven economic development policy and practice in Nordic Arctic regions for many years (Teräs et al., 2018). The following paragraphs expand on the key synergy benefits from increased interconnectedness of Smart specialisation and sustainable development in the European Arctic.

## 4. Smart specialisation and Sustainable Development in the Arctic

The Nordic Arctic regional economies are characterised both by vast natural resources and by an increasing embeddedness into global economic flows and policies. The globalisation process brings with it great potential for the Nordic Arctic to become a world leader in sustainable growth. Moreover, it brings an increased attention to international law to protect the sustainable and just use of these resources, not least in relation to safeguarding the living conditions and culture of indigenous populations. For local communities, the Arctic context is not extreme and distant, but a familiar surroundings and a place to live and work.

This makes Arctic regions a unique context for an in-depth investigation of local and regional processes of S3 for the SDGs. Addressing issues that emerge in the Arctic context, and the ways that local communities face and adapt to them, entails valuable lessons to inform policy and practice in regional development across the world.

This chapter is dedicated to showcasing some of these settings: contemporary initiatives and transitions in different Nordic Arctic regions, that demonstrate policy linkages and valuable lessons to advance the common goal of a Smart and Sustainable Arctic. The chapter concludes with a section on initial cross-case observations, which will serve as the basis for the overall conclusions and recommendations emerging from the present report.

### 4.1 Northern Finland- Lapland

#### Regional context

Lapland is the northernmost region of Finland and of the European Union. Lapland, with a population of 176,000 and with Rovaniemi as the largest city, was one of the pioneers of Smart specialisation in the northernmost part of the EU (see Teräs et al., 2018). Lapland's Arctic Specialisation Programme was published as early as 2013. It identified the following cornerstones: accessibility, the sustainable use of natural resources and natural conditions, increasing value added, making more efficient use of the expertise already accumulated in Lapland, and Arctic pride.

The more recent complementary document "Strategic Priorities for International and Smart specialisation 2018-2022": (Regional Council of Lapland, 2018) advances three priorities, which support the sustainable development of Lapland's regional development: advanced Arctic business as a foundation for the growth, Arctic expertise and renewal of innovations, and a regional ecosystem with clusters (Arctic smartness clusters) and services that enable the conditions for regional development action by strengthening co-operation between regional stakeholders and by enabling improved international co-operation. Lapland's S3 model exemplifies a comprehensive approach to Smart specialisation.

The Arctic Industry and Circular Economy exploits and commercialises Arctic natural resources and conditions while maintaining a balance of sustainable development. The Smart and Sustainable Arctic Tourism cluster aims to promote the sustainable and responsible growth of tourism in Lapland. The Arctic Design & Development Environments cluster serves as a supporting network to all clusters. The



Arctic Smart Rural Community creates new innovative companies based on a circular economy, and transfers the added value of local natural resources for the benefit of the communities. Finally, the Arctic safety cluster is aimed at strengthening interregional networks and safe business opportunities. The cluster brings together stakeholders especially in the areas of public and tourism safety.

Figure 10: Lapland's Arctic Smartness Clusters



Source: arcticSMARTNESS.eu

The Regional Council of Lapland started a process in 2022 to update the regional Smart specialisation strategy. The FOCUS project 2022-2023 aims to include the business life of Lapland-based companies in the Smart specialisation process, following the recommendations drawn from the evaluation of the Lapland Smart specialisation strategy (2021). The Smart specialisation priority areas, and the Arctic Smartness Clusters, will be analysed and updated. Moreover, the FOCUS project pays specific attention to Smart specialisation related to green transition and digitalisation. The updated Smart specialisation strategy for Lapland is expected to be released in the spring of 2023.

### Smart specialisation and sustainable development

Smart specialisation work in Lapland is coordinated by the Regional Council of Lapland, but the advancement of the work is naturally formed as broad-based cluster collaboration, with partners including, for example, Lapland University of Applied Sciences, the University of Lapland, the Geological Survey of Finland, ProAgria Lapland, and the Digipolis technology centre. The smart clusters, playing an important role as regional collaboration platforms, have been at the core of Smart specialisation work in Lapland, although the Smart specialisation commitment also goes beyond these clusters.

In addition, Lapland's Smart specialisation work developed to include a transnational dimension, given that the new 2018 strategy outlines the regional ecosystem in Lapland as the basis for internationalisation. Lapland Regional Council was also the core driving force pushing for the ELMO project 2019-2021 to prepare a joint Smart specialisation strategy document in 2019-2023 for the seven regions that make up East and North Finland (ELMO, 2019).

Lapland has been a frontrunner (and one of the leading regions in Finland) in the advancement of Smart specialisation work – an achievement also recognised by Lapland's status as a Smart specialisation example-case and expert-hub, both at Finnish and EU level. Lapland still needs additional effort to become a leading stakeholder in including sustainability and the SDGs in its Smart specialisation work. However, at least at the level of the Regional Council of Lapland and among the smart cluster partners in Lapland, the sustainable development dimension has already been recognised as a central element for Smart specialisation in Lapland. More time is needed, however, for the regional projects in Lapland to consciously take up the challenge of defining their aims and measuring their success from the viewpoint of the specific aims and targets outlined by the SDGs.



Since the original Smart specialisation strategy drawn up in 2013, Lapland has continuously committed to fostering innovation for sustainable development. Even if Lapland's Smart specialisation strategies do not explicitly take account of or benchmark themselves against the SDGs, these goals do guide the Smart specialisation work in Lapland, given that the region's own overall strategy (Lapland Agreement) already implicitly and explicitly guides measures towards reaching the SDG goals. The following SDGs are already integrated within Lapland's Arctic Smart specialisation: SDG 4 on Quality Education; SDG 8 on Decent Work and Economic Growth; SDG 9 on Industry, Innovation and Infrastructure; SDG 11 on Sustainable cities and communities; SDG 13 on Climate action; SDG 15 on Life on land; and SDG 17 on co-operation and partnerships. Lapland has also responded quickly to the ambition and core aims of the EGD and the Recovery Plan by adopting its own strategies to support these frameworks.

The FOCUS project in 2022-2023, updating the regional Smart specialisation strategy in Lapland, also prioritises sustainability issues. The updated strategy will be a Sustainable Smart Specialisation Strategy (S4). The FOCUS project 2022-2023 updates the Smart specialisation strategy as a means of promoting green transition, and developing new innovative low-carbon solutions for the core industries in Lapland. Besides ecological sustainability, the strategy update also takes into account other dimensions of sustainability.

### **The Lapland Green Deal & Roadmap**

The Lapland Green Deal & Road Map originates from a project led by the Regional Council of Lapland in 2020-2021 in order to provide a voluntary agreement among diverse stakeholders across Lapland to enforce what they call a "common goal of green development". The initiative leans strongly on the EGD initiative. The Lapland Green Deal addresses sectors including energy, environmental protection and ecological diversity, sustainable tourism, Arctic food production, sustainable use of forests, industrial circular economy, and transport & accessibility (Lapland Green Deal Road Map, 2021).

Apart from the diverse thematic areas that are of relevance in these segments (e.g. SDG 9: Industry, Innovation and Infrastructure & SDG 7: Affordable and Clean Energy), the overall necessity of taking SDG 17: Partnerships to achieve the Goal into account is addressed, as well as the approach for networking and striving for mutual achievements across regional and local industries. (Lapland Green Deal & Road Map, 2021; Flick et al., 2022).

### **Lapland Agreement**

The Regional Council of Lapland has combined the regional plan and the regional programme into a single document known as the Lapland agreement ("Lappi-sopimus") for the period 2022-2025. Lapland's Smart specialisation strategy is part of the regional programme and Lapland's strategy for internationalisation. The long-term regional development policies give a direction to development funding and supervision of interests, as well as regional planning, which, in turn, directs municipal planning and other spatial planning. Sustainability plays an essential role in several of the goals featured in the agreement. The asset of being one of the cleanest regions across the globe, referring to its nature and ecosystems, links to the overall goal to be successful in terms of sustainable development and, as stated, "Lapland should be an open and smart place in the Arctic" (Lapland Agreement).

The UN SDGs, as well as Smart specialisation in the Arctic, are presented as important points of departure for the Lapland Agreement. The Agreement also aims to regionalise the SDGs via the Lapland Green Deal & Road Map (Lapland Agreement p.11)

The following goals are included in the Lapland Agreement: the strengthening of the Arctic economy (SDG 8: Decent Work and Economic Growth); renewed ways of utilizing labour and skills for the natural environment; the creation of well-being, cultural assets, good living environment and preservation of a clean nature (SDG 3: Good Health and Well-being) and good accessibility should enable economic growth & competitiveness as well as societal well-being (SDG 9: Industry, Innovation and Infrastructure, SDG 3: Good Health and Well-being, SDG 8: Decent Work and Economic Growth) (Lapland Agreement; Flick et al., 2022).

## Lapland cases: Sustainable tourism and Industrial circular economy

### *Case 1: Sustainable Tourism*

Finnish Lapland is a pioneer in sustainable Arctic nature and adventure tourism. The development of sustainable and responsible tourism also plays a major role in the Lapland tourism strategy for 2019-2021. The projects presented in this chapter demonstrate how seriously the UN sustainable development goals and the EGD (and to some extent already the EU's Recovery Plan as well) are being taken in Lapland. EU-level plans and programmes on sustainability have at least implicitly influenced the way Lapland's tourism projects are being developed. Most visibly, Lapland as a region is implementing the new sustainable development policy frameworks by developing its own local measures, for example, the Arctic Green Deal and Road Map. Significantly, Smart and Sustainable Arctic Tourism has been an essential element of the Smart specialisation strategy & implementation in Lapland. (More information: <https://arcticsmartness.eu/smart-and-sustainable-arctic-tourism/>).

The project "Developing Low Carbon and Economically Sustainable Tourism in Lapland (2020-2022)" aims to promote the achievement of the low-carbon target in Lapland's tourism domain. The project focuses on the long-term sustainability of tourism, energy solutions, recycling and waste management, as well as on developing and advancing low-carbon and sustainability indicators, and its measures are implemented at corporate, regional and provincial levels. The project aims, for example, to provide answers to practical questions in municipalities and sub-regions (e.g. how to create new charging stations for electric cars, how to better utilise solar energy), and on tackling the difficult issue of waste management in regions where distances are long and recycling is a challenge (for instance, by seeking to clarify how much biowaste is generated and how much of it could be re-used). Moreover, the project is taking steps to create a practical, browser-based calculator tool for determining a company's carbon footprint.

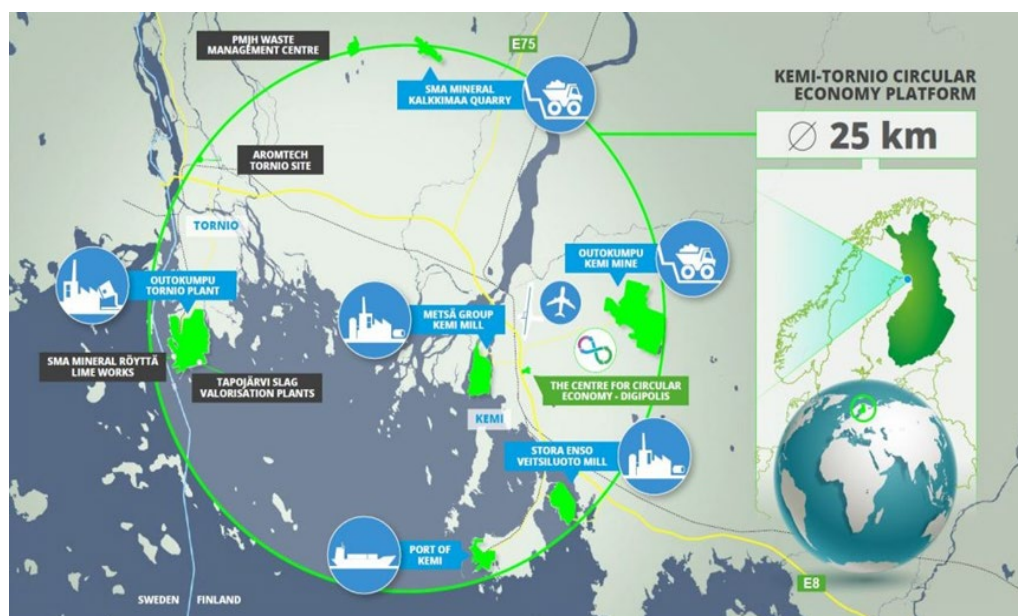
"The Ecosystem of Sustainable Mobility Services – towards resource-wise mobility services" project focuses on advancing accessibility in rural areas, and thereby contributes to the low-carbon mobility of tourism and other mobility-related domains in Lapland. The project, which due to the pandemic is still at the introductory stages, aims to support collaboration between transport service providers and tourism service providers. An important part of the project involves enhancing regional collaboration with respect to service transport. By sharing knowledge, digitalising routes, schedules, and other information about destinations (attractions, services etc.), the project adds visibility to Lapland's tourism destinations in the digital world.

Both of the projects presented clearly contribute to Smart specialisation goals and to the goal of sustainable and green tourism in Lapland. The latter project has already made plans to increase the measures regarding the resilience of municipalities and sub-regions that rely on tourism, so that the region will be well-prepared for future adversities similar to the current pandemic. Moreover, the ambition to provide digital solutions in Lapland's mobility sector is clearly a trailblazer in advancing the Europe-wide Twin Transition focus, the interlinking of sustainability and digitalisation developments.

### *Case 2: Industrial Circular Economy*

The industrial circular economy was already being developed in Lapland before the launch of the Lapland Arctic specialisation strategic framework. The Kemi-Tornio region in particular has a long tradition of utilising the potential of industrial circular economy collaboration. The region, close to the Swedish border, is a major hub for the Arctic process industry (see Figure 7).

*Figure 7. Kemi-Tornio Circular Economy platform in Lapland*



*Source: Digipolis Kemi*

One of the key milestones of the increased development of the industrial circular economy collaboration in Kemi-Tornio was the mapping of industrial by-product flows, conducted in 2013-2014. The mapping facilitated the creation of a closely-knit network of local stakeholders and encouraged matchmaking among stakeholders. More than 1.3 million tons of annual by-products and residues were identified within Kemi-Tornio's local industry with an estimated annual turnover of 200 million EUR. Kemi-Tornio's efforts in boosting industrial circular economy development and related developments in Lapland have already been recognised internationally as an impressive exemplar of implementing industrial circular economy in practice.

The Arctic Industry and Circular economy cluster was formed as a key constituent cluster within Lapland's Arctic specialisation programme of 2013, to promote and upscale the industrial circular economy efforts in Lapland.

The Industrial circular economy work in Lapland received a significant boost in 2017 when Sitra, the Finnish Innovation Fund, together with the city of Kemi, the Digipolis technology centre, and the Lapland University of Applied Sciences, started a project that established the Industrial Circular Economy Centre. The Centre has the effect of promoting and consolidating work on the industrial circular economy not only in Lapland, but also more generally in Finland (via the establishment of a network of Finnish eco-industrial parks) and across the EU (via the initiative of building up the European Alliance for Industrial Circular Economy).

The Industrial Circular Economy Centre, created by the Kemi-Tornio region, received significant national recognition in 2020, when the Ministry of Economic Affairs and Employment in Finland selected the Industrial Circular Economy Centre as the flagship project for creating the National Knowledge Platform for Industrial Circular economy in Finland for the period 2020-2022. The Platform project was part of the national transition effort towards a low-carbon society in Finland. The Platform project included, for example, network building with Nordic industrial circular economy stakeholders. Moreover, the CE Centre played an important role in creating a European-wide Alliance to promote funding of Industrial Circular economy pilots and other initiatives (TEM, 2020).

Another industrial circular economy initiative that has recently been initiated in Lapland, the project Industrial Circular Economy in Lapland 2.0 (LTKT) 2020-2023, aims to strengthen regional competitiveness of the industrial circular economy in Finnish Lapland. The project bolsters studied the work already done in the Kemi-Tornio region and expands it to other parts of Lapland. Moreover, the project forms a roadmap for Lapland's circular economy, and with the aim of identifying common indicators for measuring progress in the advancement of the circular economy in Lapland. Other goals include increasing the circular economy pilot and demonstration projects in Lapland. In particular, the project aims to enhance the capacities of micro and small- and medium-sized enterprises to participate in the piloting and demonstration efforts in the field of industrial circular economy.

The two projects described above have been heavily influenced by Lapland's Arctic Smart specialisation framework from the very beginning. The UN Sustainable Development Goals and surrounding frameworks have not yet been incorporated explicitly in these projects. Yet, the EGD has clearly acted as a background force in the foundation of the current stage of industrial circular economy work by Digipolis, one of the main stakeholders. In addition, the network of Finnish eco-industrial parks led by Digipolis (and the Industrial Circular Economy Centre) maintains an active discussion with all relevant stakeholders, including the Finnish government, as to how the EU Recovery Plan resources may be used in the best possible way. A number of promising circular economy investment cases have been presented in this regard.

These examples of recent efforts to increase and expand Lapland's expertise in industrial circular economy demonstrate the potential of a well-established regional specialisation to be empowered and scaled up through increased integration with holistic sustainability-focused strategies, such as the EGD and its related mechanisms. While the SDGs have yet to play a more significant role in enriching this development, it is clear that the empowerment of locally-led initiatives and efforts is at the core of Lapland's continuing work in the industrial circular economy, thereby aligning closely with the foundational discourse around which the SDGs are framed.

## Smart specialisation, SDGs and Lapland: reflections

The awareness of the SDGs in Finnish Lapland has been growing since at least 2017. Most Finnish municipalities in Lapland are now knowledgeable about the SDGs: Although implementation is often still pending, many intend to implement them in the future (see also Flick et al., 2022).

The Lapland region has included the SDGs in its S3 primarily to reflect on the overall vision and impacts of the supported activities on the SDGs. It is too early to say that Lapland has fully included the SDGs in its S3 and actively supports innovation niches and experimental projects which focus on sustainability challenges. According to the information received from the FOCUS project preparing the S3 update in Lapland, the SDGs will be more and more included in the regional S3 work. Moreover, system-level SDG thinking and activities have already reached sub-regional level in Lapland, e.g. the municipality of Muonio is a leading example.

## 4.2 Northern Sweden

### Regional context

The Norrbotten region makes up almost one quarter (98,911 square kilometres) of Sweden's land mass. It has a total population of around 250,000, and its three biggest cities are Luleå, Piteå, and Boden. Important sectors include mining, forestry, and hydro power. Some general regional development trends facing Norrbotten include demographic changes and urbanisation, globalisation and increasing mobility, digitalisation, and the adverse impacts of climate change. Norrbotten also faces other challenges, such as heavy out-migration of young people and women, and housing shortages reported in many urban centres. Key industries in Norrbotten include ICT and data centres, cold-climate testing, forest and bioeconomy, high-technological processing industry, mining and minerals, renewable energy production, and space technology.

The Västerbotten region, directly to the south of Norrbotten, spans 55,432 square kilometres, making Västerbotten the second largest Swedish region after Norrbotten. It has a total population of around 276,000. The largest cities are Umeå and Skellefteå. The region's sparse population presents regional development challenges such as difficulty in engaging local stakeholders in innovative environments and networks. There is considerable intraregional variation in the volume and quality of key network infrastructures, and changing demographics are putting pressure on the functioning of the welfare state especially in sparsely populated inland areas. That said, urban centres along the coastline already have good accessibility by road, sea and air (Regarding rail, Skellefteå will not have a railway connection until the Norrbottenabanan is ready). Key industry sectors in Västerbotten include high-tech processing industries, forestry, energy and cleantech, life science, ICT, and service industries (Teräs et al., 2018).

### Smart specialisation and sustainable development

The adoption and implementation of Smart specialisation started later in Sweden than in some other European countries. According to Paulson (2019), the process of developing S3 and the integration of Smart specialisation in the operation of the EU 2014-2020 programming period was started late. This partly impeded a well-consulted and thorough involvement and decision-making process by these regions. Smart specialisation has been part of the innovation policies in Norrbotten for some years, but systematic efforts to prepare and implement regional strategies based on Smart

specialisation were shaped a bit later than, for example, in Finnish Lapland. Norrbotten prepared its regional Smart specialisation strategy in 2018-2019. Västerbotten, while having taken earlier action in formulating its Smart specialisation priorities, started a systematic effort in 2020 to produce a designated regional Smart specialisation strategy.

Sustainable development is currently high on the regional development agenda for both Norrbotten and Västerbotten. The SDGs are part of the current and future regional development discourse in both regions. Several large-scale and capital-intensive industrial projects, including the LKAB, SSAB and Vattenfall investments on new environmental-friendly technologies in North Sweden and the Northvolt battery factory in Västerbotten, have placed North Sweden in the global spotlight with regards to sustainable and climate-neutral investments in emerging and fossil-fuel-replacing technologies. It is worthwhile noting that the high level availability of sustainable energy from hydro and wind power makes North Sweden a particularly attractive option when considering locations for energy-intensive industries.

**Norrbotten's** vision in the regional 2030 development strategy (Region Norrbotten, 2020a) is that the region will be the most welcoming and re-thinking region in Sweden. It aims to be a multicultural and creative meeting place for new ideas, innovation and creativity. In the Arctic environmental context, Norrbotten will constitute an important hub for scientific research and sustainable industry and innovation, not least as the region is already a hub for earth-observation satellite launches. Norrbotten's 2030 vision includes: 1) attractive living environment, 2) competence provision and increased labour supply, and 3) innovation and entrepreneurship.

Regional authorities have recently published a regional development strategy, a designated Smart specialisation strategy, and a report on regional adaptation of the 2030 Agenda (Region Norrbotten, 2019, 2020a, 2020b). Norrbotten has a long-established, strong foundation in the sustainable use of its abundant natural resources, especially in the mining industry, forestry, and hydropower. Smart specialisation brings in an additional focus and diversity, increasing the attention on significant and innovative hubs in Norrbotten in space technology (Kiruna), digitalisation (Luleå), energy technology, advanced environmental technology, the tourism (Jukkasjärvi) and experience industry, cultural & creative industries, and on innovation environments and testbeds of know-how and technology in Arctic conditions (Arjeplog).

As can be inferred from the diverse array of specialty-domains listed above, the future of Norrbotten is being built through a number of sustainable growth areas. In the current phase of deeper integration and consolidation of the relatively recent Smart specialisation and regional development strategies, the main focus is on societal resilience, and on ensuring a diverse and sustainable regional economic and industrial future. On the one hand, recent large-scale investments in sustainability innovation by energy-intensive industries have put Norrbotten on a trajectory of rapid regional growth. The broad-based sustainable industry transition process in Norrbotten, which has significantly accelerated in recent years, plays an essential role in supporting innovation and development and smart specialisation activities in Norrbotten. On the other hand, regional innovation policy is also targeted at keeping this growth path locally sustainable, e.g. with efforts to diversify the industries where new jobs are being created. According to Norrbotten's Smart specialisation strategy, the purpose of Smart specialisation is to promote smart diversification, starting from clear niches, in order to stimulate the development of new specialisations and knowledge areas. A key task is to support



innovation and development activities related to industries that are connected to other operations in the region. Cues have been taken, among other examples, from Värmland in North Middle Sweden and the Basque country, on how to further enable these developments in the regional networks in Norrbotten.

A concrete testimonial of how actively the industrial hubs and knowledge-centres are committed to these transformations was announced in 2020, when the mining conglomerate LKAB announced an extensive investment in the development and scaled-up implementation of a fossil-free steel production in a wide-ranging partnership with steel company SSAB and energy company Vattenfall (the HYBRIT development company). Based in Norrbotten, the industrial investments made in connection to HYBRIT count among the largest in Sweden's history (LKAB, 2020). H2 Green Steel is yet another industrial green transition project within the green steel domain, with a plan to open a plant in Boden in Norrbotten and reduce CO<sub>2</sub> emissions by up to 95 percent compared to traditional steelmaking. H2 Green Steel is a start-up funded by 31 investors, and the company has already raised 3.8 billion USD in funding over five investment rounds. The carbon-free steel developments are highlighted as an example for the significant interest in locating innovative green investments in Norrbotten. They are now also being actively anchored in the regional S3 strategy process, as a pioneering area of excellence for the sustainable industry transition that has global reach, but is clearly localised in established skills clusters and regional industry networks.

Norrbotten's policy agenda also includes adaptation to the SDGs (Region Norrbotten, 2020b). The systematic work on the SDGs and regional development in Norrbotten prioritises and is already a national-level contributor in work on SDG 3, SDG 4, SDG 5, SDG 8, SDG 9, SDG 11, SDG 12, SDG 13, while other targets are under further development. Crucially, these also include SDG 15 on biodiversity, through a regional forestry programme – an important element considering Norrbotten's traditional focus on the forestry sector.

**Västerbotten** is characterised by a highly skilled knowledge economy, but also by challenges of peripherality and old industrial communities. Västerbotten faces specific challenges due to an ageing population, long distances from markets, and high-cost land transport. At the same time, Västerbotten has an abundance of natural resources and opportunities for innovation, e.g. in technical solutions for infrastructure and communication networks over long distances (see OECD, 2017).

The most important strength is a skill-intensive knowledge economy, with three higher education institutions as well as active involvement in Arctic and BSR cooperation. Umeå university is part of the Arctic Five – an alliance with the Arctic University of Norway, Luleå University of Technology, the University of Lapland and the University of Oulu – that aims to share knowledge, education and research infrastructure for the development of the Arctic region and its businesses (Arctic Agenda, 2020). The Innovation Strategy for Västerbotten 2014-2020 emphasised innovation throughout the region by also investing also in stakeholders who are not easily found in already established innovation systems (see Leino & Hunter, 2020).

Regional innovation strategy 2022–2030 for Västerbotten lists areas of strength, which are defined as thematic areas or industries in which Västerbotten has several companies, clusters or knowledge environments. These areas are unique or relatively strong in a global or Swedish perspective, which means that they provide some kind of comparative advantage. These areas are important for strengthening the region's innovation capacity, and they also form the basis for identifying areas for

Smart specialisation. The key domains highlighted in the RIS strategy include: the sustainable hospitality industry; digitalisation and the tech sector; sustainable energy systems; mining and minerals; the dairy industry; forest bioeconomy; manufacturing; the cultural and creative sector; and life science.

Region Västerbotten is currently preparing a **new Smart specialisation strategy and Roadmap** which is expected to be released in spring 2023. The smart specialisation strategy and the roadmap aim to unlock the potential for sustainable transition that can be achieved through transformative innovation and innovation diffusion, extracted from the challenges and opportunities that are identified in the regional development strategy. The S3 Västerbotten Roadmap shows how Västerbotten can gather the regional resources and connect them with relevant partners and resources – across and beyond the Västerbotten region, specifically at macro-regional and EU levels. In this way, Västerbotten aims to achieve a sustainable and smart transformation process through innovation promotion and diffusion, and by leveraging digitalisation processes. S3 Västerbotten/Sweden provides a roadmap for mobilising sustainable innovation in Västerbotten in collaboration with partners across the Baltic Sea macro-region and in the wider EU territory. The S3 Roadmap outlines how transitions to a sustainable economy can be driven by collective efforts. The timing of the new Smart specialisation strategy and Roadmap is in line with the Partnerships for Regional Innovation (PRI) initiative, according to Region Västerbotten.

The purpose of the S3 Västerbotten Roadmap is threefold:

- to provide a guide for regional stakeholders to build and strengthen partnerships within and beyond the region, focusing on smart economic transformation
- to identify and fully utilise innovation potential in Västerbotten for collaboration and funding initiatives at regional, national and EU level
- to showcase opportunities for collaboration with stakeholders in Västerbotten

The formulation process of the Smart specialisation priority domains is expected to be an ongoing process. Västerbotten aims to utilise Smart specialisation in broadening the industrial value chains from manufacturing to finalised products. The region will continue and increase the political and strategic cooperation with other regions in the Arctic and Europe, including strengthening relations and interaction with, for example, the EU JRC S3 platform in Seville (see Leino & Hunter, 2020).

Region Västerbotten has undertaken significant effort to integrate the SDGs into its regional development plans (see Region Västerbotten 2019, Region Västerbotten 2019a). Systematic work on the SDGs and regional development in Västerbotten in particular highlights an increased effort to be made in the domains of SDG 2, SDG 3, SDG 7, SDG 11, SDG 12, and SDG 13, while Västerbotten's current progress on SDG 6 and SDG 16 is already at the level of the national average.

## Cases in North Sweden

### *Case 1: RISE SICS North (Norrbotten)*

As outlined in the regional S3 strategy, Norrbotten displays increasing regional strength and knowledge-intensive agglomeration in ICT, more specifically in the research and development to improve the efficiency and sustainability of data centres. This regional specialisation domain is inextricably linked to the Arctic environment and characteristics that give the region a comparative



advantage, from which an increasing number of stakeholders in the data centre domain have decided to benefit.

The strategic framework for empowering this development was sparked by the negotiation and subsequent establishment of a Facebook data centre in the university town of Luleå in 2011. Following this, stakeholders from regional authorities as well as education institutions and the private sector have worked together to enhance the development of an ecosystem of sustainable data centres and the surrounding applications and services. Key arguments in the marketing of this strategic agenda include the cool conditions (to bring down cooling costs and save energy), reliable and inexpensive renewable energy source, well-developed infrastructure, and availability of skilled workforce. Regional resilience, energy security, and the stability of political institutions are the elements with which Norrbotten's specialisation in sustainable data storage cuts across different sustainability goals, beyond the environmental benefits of lower cooling costs and renewable energy sources.

A noteworthy proponent of this development is RISE SICS North, a government-owned research institute subsidiary for computer systems development. The research output, regional presence, staff, and annual turnover of RISE SICS North has been steadily growing since moving into its new Luleå headquarters in 2016. The staff of approximately 25 administrators and researchers are in charge of coordinating up to 15 simultaneous research projects, where stakeholders in and around Luleå are collaborating to make the area a leading hub of sustainability and innovation around data centres in Europe and the world.

Current projects include several developments in the energy efficiency and circular resource management of data centres, for example by way of new applications in biomass-based energy and the recycling of excess heating capacity within the integrated local energy system. There are also developments centred around the automation and integration of the different elements and branches of a data centre, so that resource management is optimised, as well as research projects to advance the application of open data depositories as a testing ground and resource for high-technological ICT innovation by R & D stakeholders both locally and worldwide. It is the view of the institute's administrators that the holistic agenda for developing the future of data centres in Luleå should involve all aspects of the data centre ecosystem, 'from the earth to the cloud'. Many projects spearheaded by RISE SICS North are undertaken in collaboration with stakeholders in other Nordic Arctic regions.

### ***Case 2: Biofuels - TreePower (Norrbotten)***

Northern Sweden's abundant bioeconomy and forestry endowment is continuously being engaged in a growing number of promising initiatives that take a holistic and cross-sectoral approach to innovation and sustainability. One among these is TreePower, a Norrbotten-based initiative launched in 2019 with the aim of presenting a roadmap for initiating a hub for the development and production of aviation biofuels. TreePower is an ERDF-funded project coordinated by Luleå Business Region, and half of the current project funding is provided by TreePower's extensive group of operational partners. These diverse partners are leaders within their field and represent the aviation, clean energy, forestry, research, and public administration domains. The business case and roadmap for aviation biofuels in Norrbotten presents recommendations for regulatory and public policy measures that are required in

order to realise the objectives of the initiative. The current project comes to an end at the end of 2022, and the final year revolves mainly around investment promoting activities.

Norrbottn's favourable combination of regional characteristics makes the region particularly well-placed for hosting a biofuel research and production hub for the aviation industry. This is linked to several of the pioneering specialisations included in the regional S3 strategy: bioeconomy, sustainable energy, and aerospace. The recognition of this potential was the driving factor that inspired the TreePower initiative, and the readiness of regional stakeholders to advance the initiative is demonstrated by the relative lack of base research required at the onset of the project: The main competing technologies and their presence and potential in Norrbotten's context is already well known and researched.

The main focus of the TreePower initiative has been to take the next step by developing a holistic and delving business case (see Figure 12 below), which maps out the specific network of stakeholders and their different roles and production volumes in the envisioned biofuel cluster. The business case will also involve an assessment of the different existing and emerging technologies, of investment and financing options, and of the optimal site for a bio-refinery. The local provisions around Luleå provide the required capacity of clean energy, clean water, sustainable-sourced minerals, wood-based resources, and other essential parts of a biofuel supply chain. The Luleå region already hosts biofuel test laboratories that can be leveraged in research and development, in collaboration with Luleå Technical University and other stakeholders advancing knowledge-intensive research.

There are on-going collaborations with a number of existing networks and innovative clusters in the bioeconomy and clean energy domain. The significant aspect driving the TreePower initiative forward, and a determining factor behind its continued growth and success, is a shared holistic vision among the network of project partners: Sustainable development and engagement with the clean energy and bioeconomy resources in Norrbotten for a novel domain like aviation biofuel will only be successful if all dimensions of the value chain and innovative ecosystem are advanced together.

Figure 12: Business case elements integrated by the TreePower project in Norrbotten



Source: [treepower.se](http://treepower.se), Lisa Wallin

### Case 3: Batteries in Northvolt (Västerbotten)

Northvolt is a designer and manufacturer of battery cells and systems, and the first battery 'gigafactory' project to be undertaken in Europe. Founded to enable a transition to an emission-free future for European industry, Northvolt is strongly committed to delivering the world's most sustainable batteries, with a minimal carbon footprint.

Northvolt was founded in 2017, and the decision was taken to establish a gigafactory (Northvolt Ett) in Skellefteå, Västerbotten. By July 2022, Northvolt had secured close to a total of \$8 billion in equity and debt, and has a wide network of industry partners, such as ABB, BMW, Scania, Siemens, Vattenfall, Vestas and the Volkswagen Group. A second gigafactory, Northvolt Zwei, was constructed in Salzgitter, Germany (a joint venture with the VW Group). In March 2022, Northvolt announced its third gigafactory, Northvolt Drei, in Heide in northern Germany, positioned to produce batteries with a capacity of up to 60 GWh. Northvolt already employs more than 3,500 people. Northvolt Ett in Skellefteå alone is expected to employ more than 3,000 people, and the regional growth in terms of supply chains and local partners in Västerbotten is continuously growing. Apart from designing and producing batteries, Northvolt is also committed to further enhancing the sustainability of the industry by developing battery recycling processes and capacity (see Northvolt, 2022).

Although the Northvolt project is not explicitly described through Smart specialisation, the central elements of the concept are present, thus presenting a case of de facto Smart specialisation. Building the factory in Northern Sweden enables access to fossil-free and inexpensive energy sources. Skellefteå is part of a raw material and mining cluster and has a long history of process manufacturing and recycling, and because the factory will be powered by 100 percent renewable hydro power, the manufacturing process will produce close to zero carbon dioxide emissions (Teräs et al. 2018). The Northvolt establishment is the first and largest full-scale 'gigafactory' for sustainable batteries in Europe, and has played a key role as a frontrunner case in the EU-led European Battery Alliance framework. The battery factory initiative is situated amidst a growing regional competence network with relevant industrial capacity, cheap and clean energy production, and a well-functioning public administration.

While the SDGs are yet to play a more explicit role in enriching this development and while Smart Specialisation strategies have been drawn up comparatively late in the process, there is clearly both policy and business momentum to align the industry transition closer to the agenda of the SDGs. To do so successfully, while avoiding an unsustainable trajectory through a one-sided regional economy, will require substantive empowerment of locally-led initiatives and networks in a variety of sectors, also beyond tourism, ICT, biofuels, batteries and carbon-free steel.

## 4.3 Northern Norway

### Regional context

Like most of the Nordic Arctic regions, Northern Norway consists of predominantly sparsely populated, remote regions. Large land areas are mostly uninhabited (but often used for pasture by nomadic reindeer husbandries), and the distance and travel time between towns and villages can be long. Troms & Finnmark county has a population of almost 242,000, with a population density of three inhabitants per square kilometre. Troms County and Finnmark County merged into Troms & Finnmark County in 2020. Tromsø is the biggest city of Troms & Finnmark County, with almost 78,000 inhabitants. Nordland has a population of 240,000, with a population density of seven inhabitants per square kilometre. Bodo is the biggest city of Nordland County, with 53,100 inhabitants. From 2024, Troms and Finnmark will again be divided into two regional county councils, Finnmark and Troms. The county council administration of Finnmark (approximately 75,800 inhabitants is in Vadsø (population of 5,573) close to Russia and the biggest city is Alta, located in the west with a population of 21,128.

Northern Norway has a common border with Russia of almost 200 km (the Lapland-Russia border span is 400 km) in the eastern part of Finnmark. From the easternmost town in Norway (Kirkenes) there are 220 km of driving to Murmansk (300,000 inhabitants), and to Nikel, the locality closest to Norway, the distance is 40 km and less than one hour of driving. Until the Russian invasion of Ukraine there was significant traffic across the border by businesses as well as for culture, sport and shopping tourism. Frequent border crossings for people living in the border region were facilitated by specific Norwegian-Russian arrangements. A recent decline in border crossings has been caused by the Norwegian alignment with EU sanctions.

A review of the innovation strategies of Nordland, Troms and Finnmark demonstrates that innovation opportunities in Northern Norway can be created through synergies between the regions' natural resources, geographical location and R&D capacity. Importantly, while natural resources and geographical location are understood in a homogeneous way across the region, the position relating to R&D diverges across different parts of the Norwegian Arctic. There is strong R&D engagement in some parts of the region (particularly in Tromsø, also compared with national figures). However, significant parts of the Norwegian Arctic have no close local access to such well-established institutions. There are long distances to industrial clusters from many localities, and subsequently the local workforce is not included in large industrial labour markets.

Historically, business in Northern Norway has mainly been based around extracting and refining natural resources, particularly in coastal domains such as fisheries and aquaculture. New growth industries, in part "discovered" by regional S3 processes, are expected to follow this precedent and be based on developing a comparative advantage provided by nature-based products and resources. One

part of this is the process to supplement traditional industry sectors with new processes and technologies, as in the case of wind power, aquaculture, mining, and the petroleum industry. Some of these, however, compete for the same land areas, which is important to account for in regional planning processes. In this sense, S3 in the Northern Norwegian context is not only a dimension of innovation policy, but also of spatial planning. Central industries are dominated by multinational companies, whilst for example the tourism livelihood is embedded in small local businesses and in local and regional markets. Innovation index results among Northern Norwegian businesses are low compared to national levels. These patterns have given rise to structural vulnerabilities related to a one-sided regional economy. Public sector employment has remained a crucial lifeline in many communities, partly compensating for the transitions and overhauls undergone in the private business sector.

In terms of geographical location, the Norwegian Arctic has a long tradition of focusing its activities on areas of specific regional advantage (see Figure 13 for Finnmark as an example). The region offers opportunities in the energy sector – about half of Norway’s potential petroleum resources are located in the Barents Sea. The tourism sector gains its competitive edge from the Arctic location, nature, the northern lights and the midnight sun. Many wild mountain and fjord landscapes are located close to urban areas, which also creates a specific tourism advantage. Moreover, as a geographical variable often omitted from analysis: East-West relations in Norwegian Arctic communities provide a viable and promising alternative to the North-South pattern, which traditionally dominates the economic and societal exchanges in Arctic regions. Northern Norway borders both Russia and Finland to the east, offering businesses unique opportunities to reach a larger market, even though industrial cooperation with Russian stakeholders is naturally vulnerable to changes in national and international geopolitics. One of the most important issues affecting the regional economy in 2022 was the future uncertainty of the practice of unloading raw fish from Russian vessels in Northern Norwegian harbours and of these vessels buying equipment and repairs in Norway.

Northern Norway hosts the world’s northernmost university, which is also one of Norway’s largest universities (UiT, The Arctic University of Norway). In addition, one of the newest Norwegian universities is Nord university, with a large campus in Bodø and also covering the northern part of the Trøndelag region south of Northern Norway. This agglomeration of higher education institutions is notable given that the entire Norwegian Arctic is home to only 9.3% of the national population. The past few years have seen a sharp decline in private-sector-driven innovation in Northern Norway compared with growth figures at national level. There are therefore no easy shortcuts to forge a stronger connection between growth in R&D and innovation in business in Northern Norway. However, despite these challenges, the Norwegian Arctic region continues to demonstrate impressive knowledge-intensive development, anchored in inherent natural advantages harnessed in a resource-efficient and sustainable manner. Given the simultaneous strong initiatives in sustainable industry in different parts of the Norwegian and European Arctic, there is a potential opportunity to increase the exchanges and collaboratively build competences for the industry transition across the different Arctic regions. As demonstrated in the following section, there are many knowledge-based industries at the intersection between research and business in, for example, biotechnology, remote monitoring, ICT, and energy domains.

## Smart specialisation and sustainable development

When analysing regional Smart specialisation cases in Northern Norway, it is important to note that implementation of regional development models in Northern Norway differs from that in Sweden and Finland. As stated by Sörlin (2019:46), the differences between maritime Norway, Atlantic Iceland, and High Arctic Greenland compared to forest-covered continental Sweden, Finland and Russia are enormous. Another important background factor is that despite the fact that Norway is not a member of the EU, Smart specialisation became a significant tool used for encouraging regional development in the country. This engaged position towards Smart specialisation was also emphasised at an early stage by the Minister of Local Government and Regional Development, as well as by Nordland County Council, which became the Norwegian pioneer of Smart specialisation at regional level. Troms and Finnmark also decided that Smart specialisation was to be the key method for regional industrial development and have strengthened the position of S3 since 2020.

Nordland (Nordland county council, 2013) developed its Smart specialisation strategy through a decision of an innovation strategy for Nordland in 2013, highlighting and addressing the three industries contributing most to exports from the county: seafood (aquaculture and wild fish), process industries (smelters and electrolysis) and experience-based tourism. In 2022, Nordland revised the selection of industries by adding space industries to the three from 2013, and has started developing a regional plan for social sustainability and viable local communities, using both S3 and the SDGs as frameworks for the process. During and after the pandemic, Nordland has continued to address broad processes, but has split up the processes into many smaller meetings, for example, in separate local communities. This way of organizing S3 has been evaluated as successful and has thus continued post-pandemic. Moreover, the defence industry, including space projects, has entered a position as one of the region's major targets in industry development. Regional stakeholders connect this trend to the onset of the Russian aggression on Ukraine.

Troms adopted its Arctic innovation – R&D&I strategy in 2015 (Troms county council 2015). Formally, the Troms strategy is not a Smart specialisation strategy and is therefore not included in the EU listing of S3 regions. However, the strategy was developed by relying on central Smart specialisation concepts such as the Entrepreneurial Discovery Process (EDP). The Troms strategy is, therefore, defined for the purposes of this report as a Smart specialisation strategy and is included in the analysis in the same way as the Smart specialisation strategies of Nordland and Finnmark. The core industries in the S3 in 2015 were in remote sensing and earth observation, marine resources, tourism, and in supplier industries in a variety of sectors often operated by multinational companies.

In 2022, Troms then started to develop a regional plan for sustainable industrial development based on S3 principles. As in Nordland, these processes were undertaken at subregional level, by dividing Troms region into four areas, with the county council signing regional growth agreements with subregional councils. This framework includes the withdrawal of collaboration with Russian regions and preparing for changes in the activities of the Barents Secretariat, which is governed by the Northern Norwegian regional councils.

Finnmark established its Smart specialisation strategy by adopting the Regional Innovation Strategy for Finnmark - RIS 3 in 2019 (Finnmark County Council, 2019). This Smart specialisation strategy underwent revision in 2022, particularly by reanalyzing the situation of what was, in 2019, defined by the strategy as the five core industries in Finnmark. These were the energy and petroleum industry,



construction, minerals, arctic bioeconomy and experience-based tourism. In 2022 Troms and Finnmark County Council developed a new regional tourism strategy aimed at bringing the industry out of the pandemic based on the Smart specialisation methodology. Finnmark has specific conditions for industrial development based on natural resources, particularly in inland areas, as these areas are used by Sámi communities as pastures and are thereby protected by international law. Moreover, the resources are not in private ownership, but jointly owned and governed by the Finnmark county council and the Sámi Parliament. This environment constitutes a specific context for S3 as well as for handling sustainability issues – regional stakeholders still find that they lack adequate knowledge and context about the perspective and priorities of the Sami people.

The three northern Norwegian regions have developed S3 plans including many of the same core industries, where the strategies are built on connectivity potentials or synergy benefits. While the Smart specialisation strategy processes of Nordland and Troms were outlined before the adoption of the UN SDGs in 2015, the Smart specialisation strategy of Finnmark adopted in 2019, as well as the current new strategies, have been able to benefit from the analytical input of the SDGs.

### Varying approaches to S3 in Northern Norwegian regions

As non-EU member regions, the Norwegian regions can logically be expected to selectively pick up some characteristics of Smart specialisation, rather than a full integration and inclusion of all EU policy aspects. This has probably led to different approaches to the Smart specialisation strategies in the Norwegian Arctic. The main dimensions of these differentiating dimensions between regional strategies include:

- Embeddedness in governance structures
- Selection of international perspectives to integrate
- Position and role of R&D and universities
- Territorial perspectives
- Understanding of and perspectives on sustainability.

The Nordland strategy from 2013 differs from Troms and Finnmark with regards to embeddedness in governance. While the Troms and Finnmark strategies are mainly embedded in the formal and traditional governmental and planning system, the Nordland strategy has a more manifold background. The process in Nordland was foremost a continuation of a broad collaboration in a Norwegian regional innovation program (VRI), funded by the Norwegian Research Council. Nordland also involved a higher number of organisations in the Smart specialisation initialisation than did Troms and Finnmark. It can be argued that while Troms and Finnmark tries to follow an established path in the governmental Norwegian regional planning system, the Nordland process was inspired by multilevel governance, directly including regional private and public stakeholders. However, we see today that Nordland now increasingly includes its S3 planning in ordinary processes.

These differences are reflected by differences in the regions' transnational approaches. While Finnmark perceived a finished strategy as a starting point for shaping international relations and collaborations, Troms emphasised the strategy as a tool for particularly increasing the global position of its R&D institutions and Nordland sought development models and perspectives internationally, particularly in Finland. The transnational strategies can be conceptualised as *negotiations* in Finnmark, as *strengthening* the global position in Troms, and as *learning* in Nordland. For example, Nordland had

already participated in Smart specialisation type regional projects in Europe in 2012, in regional pilots around the greening of aquaculture. This was aimed at seeking to increase its base of familiar models and policy frameworks.

The Troms transnational perspective highlights the position of its R&D institutions. The core position of these institutions, most of them located in the county capital of Tromsø, is a major characteristic of the Troms strategy. In contrast, the Finnmark strategy highlights the lack of R&D institutions located in the county, in spite of the fact for many years, companies had developed close relations to the R&D institutions in Tromsø. Nordland, in turn, emphasised the importance of changing the position and role of R&D institutions, for example, by arguing to change the organisation of the universities from a Norwegian Anglo-Saxon model to a German inspired model: the Nordland S3 argued that the German model includes added focus at university level on vocational education, training and reflection on practices in these areas, as well as qualifying occupational practices for higher education studies. Moreover, we can observe differences in how the strategies have addressed territoriality. Nordland and Finnmark focus on dysfunctions in the internal structures in their specific regions. However, one of the Finnmark Smart specialisation strategy headlines addresses the importance of strengthening the links between companies in Finnmark and the much broader research, innovation and education milieus particularly in Tromsø, outside the county, again from 2021. In turn, Troms' strategy recognises this central role and puts effort into developing Tromsø as the capital for all regions in the Arctic. The smart specialisation strategy in Troms is, in other words, explicitly based on Troms already having a well-functioning regional innovation system, and may thereby also offer opportunities for linking businesses in all parts of Northern Norway to national and international networks.

Lastly, there are differences in the strategies' positions on sustainability. The Nordland 2013 strategy took a more implicit stance, arguing for example that the process industries in Nordland are greener and more sustainable than in other parts of Europe, a position that has subsequently been viewed as the basis for the comparative advantages of Nordland's export industry. In the Troms and Finnmark strategies, sustainability receives more explicit engagement. Finnmark has established sustainability as one of three core strategies (the others being Arctic knowledge and digitalisation) in the Smart specialisation plan from 2019. A central part of the sustainability strategy is blue growth, or what is termed in the plan as Arctic bioeconomy, covering tourism, fish farming, digitalisation and electrification, etc. In the Troms plan from 2015, sustainable development runs through all four priority areas in the R&D&I strategy, as the sustainability principle presents challenges and opportunities for business development in the region. Arctic Innovation, the R&D strategy for Troms, uses a definition of sustainability taken from the UN report 'Our common future' from 1987: "A sustainable society meets the needs of the present without compromising the ability of future generations to meet their own needs".

The municipalities and county councils in Nordland are experiencing a conflict between Smart specialisation as a method or tool for encouraging growth processes and the sustainability aims of SDGs (Nordland Research Institute 2020, 76-77). The report found that county administrations demonstrate shortcomings when it comes to incorporating SDGs in the planning process. This may not be surprising given that, from 2013-2014, Nordland embedded Smart specialisation strategies outside of the traditional formal regional planning system in the Nordland confederation of enterprises. The implementation of S3 in Nordland with, for example, Horizon projects in responsible

innovation, and the current county council-governed S3 project addressing viable communities, can be understood as a strategy to solve some of these contradictions.

In contrast to Nordland, Troms and Finnmark had embedded their Smart specialisation strategies in the well-established Norwegian governmental county planning framework. Nonetheless, this report's analysis leads to the finding that in Troms and Finnmark also, the positioning of SDGs in planning in 2020 was demonstrating shortcomings, for example, in mobilising and obtaining the participation of participants outside the county councils. From this point of view, it is worthwhile presenting and discussing cases where Smart specialisation also links SDGs to the county councils' strategies, demonstrating abilities to develop models that both mobilise broad processes and include policies governed at regional level.

However, in spite of tensions between national and regional levels and challenges in implementing SDGs in concrete regional processes, there are cases of interest in Northern Norway. We have categorised four such cases addressing differences in the embedding of Smart specialisation strategies and opportunities to include SDGs in regional strategies in Northern Norway. They can be seen as examples on "good" or "best practices", but they also present dilemmas and challenges in linking Smart specialisation and SDGs in Northern Norway, for example, in including SDGs in typical industries and synergies in Smart specialisation. Such synergies can be exemplified in Figure 13 from the Finnmark Smart specialisation strategy in 2019.

Figure 8. Synergies and collaboration areas listed in the Finnmark's regional innovation strategy

Industries	Synergies / identified collaborative arenas
Energy and petroleum	Seafood – supply of maintenance and manufacturing parts Mineral – supply for development and maintenance Fishing – cooperation with local fishing boats on emergency preparedness
Building and construction	Digitalization – visualize activities, work processes, planning tools Petroleum – inspection and maintenance Travel life – digital experiences
Mineral industry	Building and construction – construction phase, road and tunnel construction, use of heaps Petroleum – automation, control systems Energy – electrification, battery operated construction machinery
Arctic bioeconomy	Travel life – tourism at fish farms – how food is harvested and processed Digitalization – automation of tasks in the fishing industry / slaughterhouse, interpretation of big data Energy – electrification of fishing fleet, feeding vessels, transport
Experience-based tourism	Local food production – real raw materials: reindeer meat, fish, agriculture Digitalization – reach new markets with smart digital solutions, communicate with customers

Source: Regional innovation strategy of Finnmark. Finnmark county council, 2019

## Cases in Northern Norway

### *Case 1: SDGs through multilevel governance paths*

Nordland's strategy from 2013 has a manifold background through its initial embeddedness with a large number of organisations, followed by an open-minded transnational strategy in its search for new models of regional planning and innovation. This case demonstrates how, in 2013, Nordland

transformed its planning process into a Smart specialisation strategy by continuing an engagement for many years in regional research and innovation programmes, by challenging the content of regional innovation, and maybe most importantly by keeping Smart specialisation as a broad regional partnership. The major developments of the SDG perspectives in the 2013 strategy were highlighted by the Horizon 2020 project SeeRRI, headed by Nordland Research Institute. The aim of SeeRRI was to build self-sustaining research – and innovation ecosystems in Europe through responsible research and innovation.

SeeRRI (finished 2021) was a joint project of 12 partner organisations from five countries, financed by the European Union under the Horizon 2020 programme. It developed a framework for integrating the principles of Responsible Research and Innovation (RRI) into regional Smart specialisation policies. A central aim was to find a new way to collaborate in research and innovation activities based on a responsible mindset. Central parts of the transformation are to link up to responsible research and innovation, and to build partnerships including R&D institutions, industries, policies and public planning through Quadruple Helix models.

RRI is an approach to research and innovation that emphasises inclusiveness, transparency, anticipation, and responsiveness. RRI seeks to ensure that all stakeholders in society who will be affected by research and innovation have a voice in deciding how it is carried out, and where it ends. The European Union has defined five dimensions of RRI requiring special attention: public engagement, open access, gender equality, ethics, and science education.

In Nordland, RRI is implemented by expanding the content of innovation from products and processes in industries to innovation in management and the use of the coastal zone. The central focus is on finding new solutions involving industries such as aquaculture, traditional marine fishing, oil and gas, and tourism. Therefore, the project actively links Smart specialisation strategies to SDGs, and contributes to linking regional Smart specialisation strategies to EU programmes. In Nordland, as well as in Troms and Finnmark, regional EU network programmes are funded by the Research Council of Norway. The EU network in Nordland is headed by NHO Nordland, in Finnmark (Horizon Finnmark) by the County Council administration, and in Troms (Arctic Horizon) by UiT. In 2022, Nordland conducted a regional plan for social sustainability and viable communities. The networks and perspectives in regional S3 are being extended by emphasising that knowledge-based regional innovation and industrial development need communities to attract young people and knowledgeable staff who want to remain in the communities for long periods of their lives. These strategies mainly address coastal communities and blue industries and encourage them to change their dependence on commuting-based short time labour from Eastern Europe.

Summing up this case: SDGs enter regional Smart specialisation by extending perspectives for strengthening competitiveness and innovation in regional industries – from addressing industry stakeholders to including a greater diversity of stakeholders and enabling “responsible innovation” and sustainable communities. This approach is explicitly grounded in SDG 17 on partnerships.

### ***Case 2: SDGs through R&D organisations***

This case portrays the role of R&D in regionalising SDGs mainly in Troms from 2015 onward. This pathway of integrated Smart specialisation and SDG frameworks is mainly linked with the Troms Smart specialisation plan, which addressed the positioning of its R&D institutions, most of them

centered in the county capital of Tromsø and playing a significant role across Northern Norway. The Troms Smart specialisation plan emphasised large ongoing research projects, in particular two projects called Barcut and Environmental Waste Management (EMWA). The projects studied the effects of oil, gas and mining operations in a cold climate, and identified operational methods to reduce pollution. Several potentially innovative solutions with commercial potential were identified through these projects. Moreover, SFI (Centre for Research-based Innovation) projects were argued to have innovative potential, and the smart specialisation strategy additionally mentioned CAGE (Centre for Arctic Gas Hydrate, Environment and Climate). This project, still on-going, studies gas hydrates in the Arctic in order to identify the effects they may have on the marine environment and future global climate patterns. The regional smart specialisation plan also described UiT's involvement in transition processes in the Finnfjord smelter in Troms (more in Case 3 below).

Moreover, the case presents and discusses the role of SDGs in new innovation strategies in R&D institutions. But due to the direct impact of these institutions on regional industries and welfare, it also discusses the institutions that include SDGs in the monitoring of their own activities and initiatives, aligning with the 2030 Agenda.

By 2020, UiT had launched at least three large projects in the previous years of relevance to this dimension. Firstly, ARC (Arctic centre for sustainable energy), which investigates and demonstrates renewable energy production by developing solar cells and batteries to improve local and regional energy systems e.g. in small, remote and sparsely populated fishing communities with high capacity in the blue industries ("Smart Senja"). Secondly, CANS (research on antibiotics resistance strategies), and thirdly, population studies in the High North: Projects that analyse effects of health policies for population welfare and health. These projects may conceivably be aligned particularly well with SDGs 3, 9 and 11.

Regional Smart specialisation strategies are closely connected with innovation strategies, and with policies where systems of collaboration between the R&D institutions and regional industries are central. The UiT's innovation and entrepreneurship plan 2020-2025 and the revised plan for RSA (informal council for collaborations with regional industries, a state-encouraged collaborative framework) include few signposts to the SDGs. The plan was developed during a process run by HEINNOVATE - an initiative of the European Commission DG Education and Culture and the OECD LEED Forum. HEINNOVATE has led the process aiming to position European universities in entrepreneurial discoveries processes in Smart specialization strategies. The process, however, has not included SDGs in a university plan. A relatively modest alignment with the SDGs is also visible in the innovation and entrepreneurship sections of the strategies of Nord University.

In contrast, the research institutes SINTEF (one of Europe's largest independent research organisations) and NOFIMA (a large public institute for applied research within the fields of fisheries, aquaculture and food research) have included, and de facto incorporated the SDG into their new innovation strategies. This includes mapping the allocation of research and innovation projects between the different SDGs, and thereby also monitoring the activities according to the goals and specific targets. NOFIMA's innovation strategy addresses nine of the SDGs (2, 3, 8, 12, 13, 14, 15, 17), and thereby de facto links up to innovation and SDG processes in blue industries. Akvaplan NIVA has, moreover, further strengthened its position towards the SDGs by becoming part of the UN platform on sustainable business in Arctic, the United Nations Global Compact. Within this platform, industries are encouraged to take an increasing role in solving challenges in sustainable development

issues. The platform encourages sustainability by increasing industrial production, added value, and regional employment. Summing up this case: SDGs enter regional Smart specialisation through education, research (basic as well as applied science) and outreach from universities and R&D institutions.

### *Case 3: SDGs through greening based on synergies in industry*

All of the three regional county councils in Northern Norway address energy transformation and the greening of industries in their Smart specialisation strategies. In particular, hydrogen strategies, including using ammonia, are developing very rapidly in Northern Norway. Today 18 of the 50 hydrogen projects in Norway are located in Northern Norway.

Some of the most significant advantages and specific opportunities for establishing these projects in Northern Norway are regional power surpluses and a high frequency of ships and vessels operating along the coast. Green hydrogen is an important EU priority, aiming to increase the production by 670% during 2024-2030. Hydrogen initiatives and investments are also categorised in the EU taxonomy. Moreover, due to the Russian aggression on Ukraine, prices for natural gas have increased so much that producing green hydrogen has become more profitable than for example blue and grey type hydrogen.

From an S3 perspective, the regional hydrogen policies demonstrate manifold S3 synergies: There is a clear synergy between local knowledge on energy in the Nordic Arctic, including international research on renewable energy, and the global need for green energy and fuel in shipping, public transportation and fisheries. Surplus heat from production can also be used as heat in local private and public heating systems. Troms and Finnmark county council has developed its role in these strategies based on S3 principles. This mainly takes the form of working out opportunities (as EDP) based on mobilising, pushing and co-ordinating a broad range of participant stakeholders. But these priorities are also visible in the counties' own purchasing strategies, e.g. demanding faster and cleaner ships for regional transportation.

The point of departure for regional strategies are communities where the capacity in ordinary power grid is low, there are no available batteries, and where conditions are particularly good for wind energy production. In this context, hydrogen is the most suitable way of storing and transporting energy, even accounting for the significant energy used in the production of hydrogen. Finnmark prioritises "trapping wind-power" for the production of hydrogen, which could be a way of storing, transporting and exporting energy. The pioneer project, also a Horizon-funded initiative, is based in Berlevåg in Finnmark, an area with excellent conditions for wind-power production, but low capacity in the power transmission out of the village.

The Horizon project (HAEOLUS, 2022) is aimed at developing and testing new technology in transforming wind power into what is known as green hydrogen, which is hydrogen produced from wind and solar industries. Berlevåg (a commune of about 1,000 inhabitants) has always been dependent on fisheries. If this project succeeds, the one-sided economic structure could be significantly changed, making the municipality substantially less vulnerable. This type of greening initiative therefore closely follows the background and core idea of synergies in smart specialisation. A small hydrogen plant in the village was opened in 2022 (see figure 14). In another commune



(Lebesby) a new floating production of green energy is planned based on local wind energy production, aiming to reduce the need for land area and thereby decrease conflicting development interests.

The Troms Smart specialisation plan from 2014 argued that the Finnfjord smelter plant is the world's most energy-efficient smelting plant. Through an investment round of EUR 80 million, the innovation process at the plant has managed to reduce energy consumption in the ferro-silicon process by up to 40%. The Troms 2022 industrial plan based on sub-regional S3 processes is organised around three strands, where the first is the greening of industry. By implementing greening processes in four sub-regions, the S3 process addresses opportunities for sub-regional specialisation around industrial development.

The Nordland Research Institute recently launched the TIPPING+ project (2022), also funded by Horizon, focusing on enabling positive tipping points towards clean-energy transition in coal and carbon intensive regions. These challenges are most acute in highly carbon-intensive regions that are economically dependent on fossil fuels. National and international climate mitigation policies and strategies often do not consider the nuanced needs and real conditions as well as opportunities present at regional level, resulting in misalignments between (inter) national climate policy goals and local priorities.

Additionally, national climate policies (e.g. Nationally Determined Contributions) do not only lack the ambition needed to meet Paris Agreement goals and the SDGs, but often lack credibility at regional and local levels as the longer-term climate goals do not resonate with immediate socio-economic needs. The project enacts positive tipping interventions for clean-energy transition to support climate policy, and assess and provide practical recommendations to support the most effective tipping activities to be implemented by regional stakeholders. 20 territories are included, two of them in the Arctic. They are concerned with the transition from coal mining and energy production based on coal on Spitzbergen, and the transition from planning for oil and gas production in the Lofoten region in Nordland, toward alternative models based on resources other than fossil fuels. To sum up this case, the SDGs are addressed in the regional Smart specialisation processes by developing new green synergies in the regional industry.

Figure 9. Mapping hydrogen projects in North Norway



Source: <https://www.kbnn.no/artikkel/lovende-framtidsutsikter-for-hydrogenproduksjon-i-nord-norge>

#### Case 4: SDGs linking to blue growth processes

S3 and the SDGs in Northern Norway are almost always related to blue growth, i.e. growth in marine and coastal resources. They are embedded in different governance systems and organisations, but they all contribute to developing this important domain for Northern Norway, which is also of crucial importance for the Norwegian economy as a whole. This fourth case more specifically demonstrates how all the regional processes in Northern Norway have been connected to Smart specialisation and SDG strategies that address blue industries in Northern Norway.

The following points recap key processes addressing blue growth in Northern Norwegian regions:

- *Entering territorial coastal innovation processes.* The implementation of Smart specialisation has included innovation in coastal zone planning processes in innovation processes. Thereby the focus changes from addressing processes and products in plants and harvesting, to territorially based opportunities for growth. By addressing coastal zone planning and sustainable, attractive and viable communities, the SDGs gain an obvious and clear leverage position in regional innovation.
- *Greening of energy used in coastal industries.* Both the improving and renewal of energy sources, including regional energy companies in “Smart Senja” (an island with small and remote communities with vulnerable energy systems that have high production volumes in fisheries) and the Nordland Research Institute’s TIPPING+ in Horizon 2020, have blue growth

dimensions. The projects aim to develop blue industries by transforming regional and local energy systems through the integration of energy from local renewable sources. The “final users” of hydrogen in coastal industries and transportation are also addressing blue growth.

- *New synergies based on collaboration between blue industries.* One key example is the cooperation of the oil and gas industries with local fishing boats on emergency preparedness. An example of this type of initiative is “Arctic contingency planning”, whereby the fishing fleets’ knowledge of coastal areas is leveraged in contingency planning for oil spills. Another is the use of residual parts of raw fish in agriculture for improving soil or animal feed.
- *Greening processes in other industries.* This dimension is about incorporating knowledge from biotechnology into traditional blue industries. Today this is developed further by focusing on the nutritional content of the micro-algae. The algae are analysed for use in salmon farming (as nutrition) as well as in biofuels, and the research process analyses the smoke emitted from a smelting plant.
- *Sustaining coastal tourism.* The first regional Smart specialisation strategies were not clear on how to support sustainability in regional tourism. However, the starting point was clear: a spectacular, clean Arctic coastal nature as well as the potential to increase the industry’s sustainability in social, environmental and economic terms. The three regional smart specialisation plans have addressed sustainability in Arctic tourism. Of the core industries in Northern Norway, tourism was hit hardest by the pandemic which caused layoffs and bankruptcies and created challenges for the recruitment of new employees from a tight labour market. After the pandemic the most visible impact has been a decrease in cruise traffic. The Russian aggression on Ukraine from 2022 and the absence of Russian tourists due to closed borders in Eastern Finnmark have affected tourism in the most remote parts of the region. The regional strategy for responding to SDGs and the pandemic is partly based on developing tourism as a diverse and strong experience industry that encourages tourists to stay for longer periods.
- *Strengthening SDGs in innovation strategies of R&D processes in the blue industries.* New innovation strategies in core applied research institutions address blue industries, specifically by detailing and allocating the research projects between nine of the SDGs, and by engaging with a global UN platform for more direct RDI involvement with companies in the blue sector.
- *Changing developing models in blue sectors.* It is important to note that the pandemic and the Russian aggression on Ukraine have challenged existing development models in northern blue sectors. In marine fisheries this is due to the position of landings of Russian raw fish particularly in the fisheries in Troms and Finnmark. Norway still has three harbours open (Tromsø, Båtsfjord and Kirkenes), allowing Russian vessels to deliver raw fish. This system is based on exemptions from the EU sanctions, but is grounded in the importance of these fisheries and dates back to the transition from the Soviet planning systems to a market economy in the early 1990s. Moreover, in the tourism sector, the pandemic (as well as climate policies) has increased the vulnerability of Nordic Arctic tourism due to the increased questioning of the viability of long-distance leisure travel.

Summing up: in Northern Norwegian regions, SDGs are mainly linked to blue growth. A major challenge is to encourage fisheries and tourism in coastal communities to engage in innovation processes in energy. However, these processes are affected by the adverse effects on fisheries and tourism brought about by the pandemic and the Russian aggression on Ukraine.

## 4.4 Cross-case synthesis

The preceding regional analyses have been focused at local and regional level, highlighting an array of detailed initiatives and processes that exemplify how the Nordic Arctic regions are in practice tackling the high-level ambitions of the sustainability and Smart specialisation policy agenda. While these example-cases are nuanced and context-specific, certain patterns are emerging from these observations.

This subsection brings up the most important patterns and commonalities visible across the Nordic Arctic context. This step seeks to bridge the analytical focus between micro-level assessment on local level in communities and companies, regional level development by S3 processes, and macro-level frameworks, thereby informing the overarching conclusions and recommendations that are developed in the subsequent chapters of the report.

### **Adopting the smart sustainability and sustainability frameworks**

In policy terms, the Nordic Arctic regions have a lot in common in regard to how they view and adopt Smart specialisation and sustainability frameworks, but these developments have also emerged and evolved at their own pace and in different ways depending on the regional authorities and stakeholders involved. Smart specialisation was introduced in the Nordic Arctic during the time period ranging from 2013-2022. The pace of adopting the Smart specialisation concept in substantive policy processes varies significantly between regions, from early adopters (e.g. Lapland in Finland and Nordland in Norway), to regions where more active adoption and implementation only took off at a later stage (e.g. Norrbotten in Sweden). In terms of the sustainable development policy agenda, the pace of adoption and integration into regional development has been somewhat more synchronised across the Nordic Arctic.

At the time of writing, most regional authorities are at the stage of integrating the SDG framework and the EGD policy targets, as well as the key tenets of the EU Recovery Plan, into their existing regional development, sustainability and Smart specialisation frameworks. In some regions, such as in Finnish Lapland, there has been a detailed selection of which SDG areas to focus on, whereas in other regions the integration is more fluid. For example, in Västerbotten, both the SDGs and related EU climate-neutrality targets are high on the agenda in the process to refine the Smart specialisation strategy for the region. In many regions, the language and framing of S3 has been adapted to make it more aligned and better understood by local stakeholders, while still maintaining the connection to the centralised policy process of S3.

### **Key stakeholders driving S3 for SDGs**

In process terms, a trend clearly emerging from a comparison of the regional observations is that the work on Smart specialisation and sustainability is sometimes explicit, but has often been driven by various other stakeholders in addition to regional authorities. The social networks and business communities within and between the Nordic Arctic regions are closely knit. This has clearly been leveraged into an agile and predominantly well-coordinated pace of pluralistic regional development and shared leadership. Apart from regional councils, some of the key stakeholders active in the cases described above include city-level public authorities; quasi-public stakeholders in energy, transport and industry; cluster organisations and science parks; private companies; universities; and civil society organisations.

A particularly impactful demonstration of the collaborative dynamic is that regional industry clusters are both engaging, and being engaged, with stakeholders across their regions and across the Nordic Arctic – these clusters remain place-based entities, but are networked with each other and act as major hubs of learning and progress for the entire Nordic Arctic region instead of only focusing on their immediate geographical proximity. Another key development to emphasise is that the wider inclusion of the SDGs and broader sustainability policies seems to have inspired a process of revisiting some old perspectives and axioms on regional innovation and the role of the public sector. As seen clearly in the examples brought forward from North Norway, stakeholders were actively reminded of the bottom-up nature of truly creative and transformative regional phenomena, and sought to develop alternatives to the established innovation policies of ‘picking winners’ among existing companies.

Finally, it is important to specify that while the impetus and implementation of new initiatives and their integration with global and EU policy agenda is shared by several diverse stakeholders, the overall coordinating responsibility and agency has remained firmly with the regional authorities. The regional councils develop strategic frameworks and are the key bridge between the local communities and national or EU policy stakeholders. It is particularly noteworthy how actively the Smart specialisation concept has been developed and has also devoted policy attention among the regional authorities of the non-EU regions in Norway.

### **Industry structure, sustainability, and climate change**

In substantive terms, it is clear that there is much more uniting the key domains and focus areas of the Nordic Arctic regions than there is divergent development. Naturally, some industries are present only in certain parts of the analysed area, such as the blue growth developments in Norway in the North Atlantic, which are in many ways substantively different from the Baltic coastal activities in Finland and Sweden. But on the whole, the perspectives, key trade-offs, and future outlook for a smart and sustainable Nordic Arctic are strikingly concerted. Even without the explicit references to the SDGs or the EGD, sustainability is involved and inextricably woven into all existing regional Smart specialisation strategies of the Nordic Arctic.

The interplay between the smart leveraging of the opportunities granted by the Arctic natural resources and the sustainability issues and severe climate change threats is also recognised across all regions and placed at the centre of the regional policy discussion. These themes are echoed in industry investment: A great majority of the new industrial initiatives developed and emerging in the Nordic Arctic revolve around sustainable resource use and a green industrial and energy transition (for example, batteries, hydrogen, and carbon-free steel). Some of the biggest challenges and controversies, but also some of the most transformative case-examples highlighted in the regional observations, feature heavy industries and their increasing momentum and pressure to phase out fossil fuels.

## 5. Conclusions

The study reveals that sustainability issues are high on the agenda in the Nordic Arctic regions. The regions in North Finland, North Sweden, and North Norway increasingly take sustainability issues into account in their regional development work. There is considerable variation between the regions regarding both the centrality and pace of adoption of the Smart specialisation concept. There is also (albeit to a lesser extent) variation in the level of integration of sustainability in the regional Smart specialisation strategy and practical implementation. However, sustainable development is being embedded in the regional Smart specialisation strategies to some extent across all the regions analysed. In all regions, the S3 and SDG frameworks are also being specifically applied and linked to broader regional planning and development strategies and processes. This work to align the different policy processes is more advanced in some regions, while in other regions there is still more potential for situating the policy agenda of S3 for SDGs as efficiently as possible in the wider regional policy agenda.

Perhaps the most remarkable feature of the work undertaken in the Nordic Arctic on smart and sustainable regional development is the collaborative and shared momentum by which it is propelled, uniting stakeholders from across the Nordic Arctic regions and from different industrial domains. Neither the business stakeholders, nor the regional authorities nor the local community organisations in the Nordic Arctic regions have any doubts about the gravity of the systemic and interlinked challenges facing their livelihoods and the survival of their native environment.

While naturally there are challenges and disagreements over the most desirable path for the future, all these different stakeholders are taking determined and creative steps to face the challenges and to not fall behind the European core regions in the fight against the climate crisis and a transition to a sustainable European economy. The regions may be geographically peripheral from the perspective of Central Europe, but their policy engagement is far from peripheral: In many domains, policy implementation and innovation are at the cutting-edge in a European comparison, making a strong case for increased dialogue and analysis that links the Nordic Arctic Regions with European networks. Nor is the Nordic Arctic peripheral in terms of technology, innovation and industry – the know-how and clean energy and material resources of the Nordic Arctic regions play an increasingly central role in worldwide green transition and sustainability measures. These large-scale and capital-intensive processes do, however, also imply significant challenges and opportunities at the level of the local communities. The urgent need to address the demographic and social challenges of sparse and remote communities, while safeguarding the status and livelihood of the Sami indigenous populations, remains a key policy issue across the Nordic Arctic region.

The research questions of this study, as set out in the introduction, are focused on tracking the latest developments in regional Smart specialisation policies in the Arctic regions; on synthesising Smart specialisation strategies and sustainability with the SDG framework in response to Arctic challenges; on outlining the biggest opportunities and challenges from this synthesised response; on demonstrating state-of-the-art good practices in the Arctic on Smart specialisation strategies for sustainability; and on making recommendations for the further facilitation of these collaborative/systemic efforts. The following paragraphs summarise, in turn, the authors' reflections on these questions based on the report study undertaken.



Regarding the **latest development in regional Smart specialisation strategies** in the Nordic Arctic, it can be stated that there has been considerable upgrading in recent years in the work to prepare and update the regional Smart specialisation strategies, and in the implementation of these strategies. In North Finland, the international activities and networking related to regional Smart specialisation have been in specific focus. In North Sweden, regions have prepared or are currently preparing thorough Smart specialisation strategy documents. In North Norway, the S3 processes of the three county councils (formally from 2024 when Troms County Council and Finnmark County council form separate counties) are more and more similar to each other. They all include the governing of the plans and processes in the policies and planning system at regional level.

Regarding the **embeddedness of Smart specialisation and sustainable development**, variations exist between the regions studied. All regions, however, are currently investing in green transition and sustainable development. The majority of the regions emphasise the use of the SDGs as an integral part of their regional development and include sustainability challenges in the Smart specialisation processes. Connecting the SDG framework and related EU policies as explicit parts of Smart specialisation is currently in the introductory drafting process in several regions e.g. in Lapland, Finland. In other words, SDG issues are gradually becoming more and more "mainstream" in regional processes in all of the Nordic Arctic regions. There is raised awareness about S3 and SDGs, but it would be too early to say that the regions in North Finland and North Sweden have fully included the SDGs in their S3 work. In North Norway, the county councils are increasingly embedding SDG-anchored S3 processes at sub-regional and local policy levels, involving a broad number of stakeholders at these levels.

The **opportunities surrounding the embeddedness** of sustainable development and Smart specialisation in the Nordic Arctic include an increased dialogue between the key stakeholders on economic, social, and environmental sustainability. Even though the broad view of innovation is emphasised in the Smart specialisation literature, the concept of Smart specialisation is sometimes seen as "smart only", leading to less emphasis on ensuring sustainable and inclusive approaches. The emphasis on sustainability in the Nordic Arctic is also welcomed because it highlights the sustainable utilisation of Arctic natural resources and socially sustainable operations in Arctic communities. The challenges from this synthesised response of sustainability and Smart specialisation may include adding to the complexity of concepts, especially among local practitioners perceiving Smart specialisation, sustainability and SDG-linked frameworks as externally driven processes. Investment in clear and high-quality communication is important in this regard: The synthesis of S3 for SDGs deserves to be communicated not only to small groups of traditionally active regional R&D stakeholders, but also, more inclusively, to a broad group of stakeholders, and the S3 for SDG agenda needs to be anchored as an inherent part in the wider regional development and sustainability agenda in order to be effective and more approachable. This is where the core content of the SDGs, specifically addressing and mobilising local stakeholders, is already making fundamental changes to how regions are grounding and localising their S3 processes.

This study highlights a number of **state-of-the-art good practices and dilemmas** in the Arctic in Smart specialisation strategies for sustainability. The good practice cases range from significant industrial investments toward green transition (e.g. batteries, hydrogen and carbon-free steel) to the development of regional knowledge platforms of green stakeholders and to initiatives to incorporate sustainability- and SDG-thinking tangibly into prioritised themes or sectors e.g. linking to blue growth

processes and energy production. We have not limited the analysis to proven success stories only; instead, we have also brought forward some new initiatives, still at the pilot stage, for which the development in added value potential remains to be revisited in the future. It is important to diversify, and to understand that good practices have different scales and challenges.

Regarding the **further facilitation of collaborative/systemic efforts** in the Nordic Arctic, the importance of joint activities cannot be overemphasised. Excluding some exceptions in the form of good practice cases discussed by prior studies (see Teräs et al., 2018), **interregional/transnational cooperation in Smart specialisation has not yet been at the core of activities in the Nordic Arctic regions.** The challenges of demography and attracting a competent work force in the Nordic Arctic further underline the need for cooperation and collaborative/systemic efforts across the Nordic Arctic. The network of universities, research institutes, and learning institutes plays a significant role in this regard.

Sustainability embedded in Smart specialisation has the potential to inspire increased interregional/transnational cooperation and learning, as regions are at different stages in these policy processes but share many structures and challenges in common. Future facilitation also needs to include policy issues and the agency of indigenous populations more directly within regional S3 processes.

In recent years, the Nordic Arctic has experienced a period of **unexpected changes caused by the pandemic and the consequences of the Russian invasion of Ukraine.** These changes put the Nordic Arctic regions to the test especially from the perspective of regional resilience: economic and social resilience, and resilience related to geopolitical issues. Smart specialisation and sustainability will remain key concepts in the coming years for the Nordic Arctic regions also from the viewpoint of resilience issues, as the ongoing crises have disrupted longstanding ways of working and collaborating across borders as a means of sustaining and further developing livelihoods in Nordic Arctic regions.

## Lessons learned from Northern Norway

Norway, as a non-EU country, has adopted the Smart specialisation concept as a major instrument of national and regional R&D and innovation policy. North Norway continues to strengthen efforts to further develop the Smart specialisation concept.

The regional Smart specialisation efforts in North Norway have been able to discover smart innovation opportunities of different types. The case presentations demonstrate that the SDGs have been linked to, and included in, Smart specialisation implementation processes. Despite variations in when (2013, 2015, 2019) county councils have adopted the Smart specialisation concept. We have not identified major differences in the implementation of SDGs between the early adopters and the county applying Smart specialisation at a later stage, even though two of the Northern Norway regions decided their Smart specialisation prioritisations before the UN launched the SDGs. This may underline the importance of Smart specialisation in discovering and addressing regional SDG action. The North Norway cases demonstrate that the inclusion of SDGs at regional level in Arctic Norway is approached differently with Smart specialisation than without, and that specific characteristics of Smart specialisation at regional level have impacted the implementation of the SDGs.

Actual Smart specialisation and SDG innovation opportunities in North Norway are about combining the region's natural resources (often maritime related), geographical location, and R&D. How this is

done in Nordland, Troms and Finnmark varies, and the different regional Smart specialisation processes give the implementation of SDGs specific regional-level directions. Consequently, as the formation and implementation of Smart specialisation varies among these strategies, the directions taken in including SDGs also vary between the county councils.

The SDGs have encouraged revision of, and new perspectives on, regional innovation processes by developing alternatives to established innovation policies of 'picking winners' among companies. These perspectives give societal dimensions more central roles in regional innovation processes. Important concepts include broadening innovation processes linked to "responsible research and innovation" and "innovation in coastal zone management".

The biggest opportunities are found predominantly among "external" stakeholders and well-established companies, mobilised and included in the Smart specialisation processes at regional level. Thereby regional S3 processes challenge local vulnerability caused by economic specialisation. The biggest challenges are to include SDG linkages in formal regional planning systems, such as in county plans. After 2020 we see, however, that all North Norwegian county councils are strengthening the integration of S3 and SDGs in their planning and governance. The debates at regional level on whether S3 should be included in traditional regional planning have positioned the counties as tools for new types of networking, mobilisation and co-ordination.

It is of specific importance in the Smart specialisation processes in Northern Norway to involve, and learn from, transnational stakeholders and areas. The selection of cooperation stakeholders and areas has already influenced the characteristics of SDG implementation in regional development. The close relations between Nordland and Lapland have been important for both regions in this regard.

The role of EU funding, mainly by the Horizon programmes, has been central and important for the transition of regional innovation processes through Smart specialisation as well as for integrating the SDGs.

SDG links have been increasingly important for conducting large-scale research projects by Smart specialisation partners such as universities and R&D stakeholders. Research-focused examples reported from Northern Norway include close collaboration with industry and public partners. The examples demonstrate "bottom up" initiatives, where, for example, university projects have been supported with large amounts by the universities' ordinary state funding.

The North Norway cases have demonstrated that regional EU networking programmes funded by the Research Council of Norway and implemented at regional level are of huge importance for linking regional Smart specialisation processes to the opportunities and concepts in the Horizon programmes.

Smart specialisation processes have encouraged R&D collaborations and industrial stakeholders as increasingly central institutions in regional innovation. As a result, the implementation of SDG targets at regional level in the Norwegian Arctic is more and more dependent on strategies and activities in these organisations. It is therefore of importance for universities and R&D institutions to include the SDGs in their own actual innovation strategies to enable SDG implementation at regional level.

## Lessons learned from Northern Sweden

In Sweden, the adoption of Smart specialisation and implementation started later than in some other European countries. Sustainable development, however, has been high on the agenda in North Sweden for a long time. Sustainability, “hållbarhet”, was emphasised in regional development planning long before the UN launched the SDGs. The SDG thinking has been well received in North Sweden as an instrument to present regional sustainability thinking in a way that is internationally recognised and comparable to other regions. The more substantive embedding of the SDGs into regional Smart specialisation strategies is currently underway, as Norrbotten and Västerbotten started their more systematic Smart specialisation processes only relatively recently.

There are promising opportunities to further integrate the Smart specialisation concept to sustainable development both in Norrbotten and Västerbotten. The emphasis on sustainability, also including large-scale industry investment, has paved the way for sustainable “S3 and S4” thinking in Norrbotten and Västerbotten. The Regional Councils in Norrbotten and Västerbotten pay considerable attention to sustainability issues in their analyses and publications, and initiatives launched in cooperation with these bodies highlight a holistic approach to sustainable innovation and development, where all parts of the regional competence network are mobilised.

Northern Sweden may face challenges in comprehensively integrating Smart specialisation in the regions – due to the relatively late launch of Smart specialisation in Norrbotten and Västerbotten, stakeholders need additional information not only about the embeddedness of sustainable development and Smart specialisation, but also about the Smart specialisation concept itself. There are several instances where initiatives in Norrbotten and Västerbotten with de facto smart specialisation – i.e. with initiatives to collaborate in mutual regional strengths by stakeholders or regions with a less formalised collaborative framework than smart specialisation – are linked ex-post to formal Smart specialisation frameworks as those regions expand and develop their own Smart specialisation strategies (see Teräs et al 2018).

In particular, further efforts to anchor their flagship sustainable industry transition projects (batteries, carbon-free steel etc.) to S3 for SDGs presents a substantive opportunity for Northern Sweden to continue their impressive development trajectory in the coming years with a perspective of equitable, holistic, and locally-driven development, at the crossroads of Smart specialisation and the 2030 Agenda. Northern Sweden is undergoing significant transitions related to green industry innovation – these large-scale projects seem to dominate much of the regional innovation discussion. It should be noted that this also heavily influences the resilience and sustainable development strategies of the two regions, which are now facing severe labour shortages and affiliated challenges relating to the fast and potentially one-sided growth of the regional economy. Regional and municipal strategy processes are increasingly formalising S3 and SDG frameworks as tools to strategies for these cross-cutting challenges and opportunities. This is particularly recognised when it comes to an equal and diverse innovation and regional development strategy, which means including a variety of local community and SME stakeholders alongside large-scale industrial projects.

Finally, the increased focus and facilitation of integrating sustainable development and Smart specialisation occurs at an extremely interesting time in the early 2020s, as the new EU programming period 2021-2027 takes off, and as the first projects of this period start up. Communicating the

possibilities of sustainable Smart specialisation is an important task not only for regional authorities but also for the wider stakeholder network in Norrbotten and Västerbotten.

## Lessons learned from Northern Finland

Lapland was one of the pioneering regions within the EU to introduce formal Smart specialisation strategies in the period 2014-2020. The most recent developments have the effect of more consciously incorporating the UN SDGs, the EGD and the Recovery Plan in the work and process of Smart specialisation.

The Regional Council of Lapland has been the driving force of the Smart specialisation work in Lapland from the beginning. It is this body that has also steered the Smart specialisation work to the next level by adopting SDG, Green Deal and Recovery Plan perspectives of its own. In this way, Arctic Smart specialisation in the future will be undertaken so that sustainability and environmental dimensions (and pandemic recovery) are emphasised in Smart specialisation work. Given that the Regional Council leads this work in the county, Lapland's own strategies can be expected to have the effect of prioritising projects (also influencing the work of the Smart specialisation clusters) that support sustainability and environmental values in Smart specialisation work.

As the tourism and circular economy case-studies from Lapland exemplify, sustainable and green economic specialisation is possible in Lapland and provides more lasting long-term economic specialisation. There are still challenges to conduct this work consciously, as the case-studies also demonstrate, including lack of understanding about how to systematically advance SDG targets, Green Deal and Recovery Plans goals, even if the Regional Council of Lapland is now taking the next steps and adopting its own frameworks to influence the project work to take account of the requirements of these international level instruments.

The Regional Council of Lapland has been able to take action in terms of advancing the multi-stakeholder process of Smart specialisation work in Lapland from a very early stage. It is this body that now further integrates SDGs, Green Deal and Recovery Plan objectives as part of the Smart specialisation work in Lapland. This is visible in the two case-study examples, in which Smart specialisation takes clear and increasing account of sustainable and environmental dimensions.

Further facilitation of sustainable Smart specialisation in Northern Finland would be strengthened by the full utilisation of the Smart cluster network which was created in 2014-2020. The Smart Clusters, especially the Arctic Industry cluster, demonstrate the possibilities for strengthening the Arctic regional expertise with EU thematic networks and alliances. The currently ongoing Focus project 2021-2023 in Lapland is expected to update - and upgrade - the Smart Cluster network, in close cooperation with e.g. the business sector in Lapland.

As a concluding remark, it can be stated that the Lapland region has included the SDGs in its Smart specialisation agenda primarily to reflect on the overall vision and impacts of the supported activities on the SDGs.

## 6. Policy recommendations

Long-term sustainable development in the European Arctic is an issue of critical importance: how to combine the protection of vulnerable Arctic nature, including e.g. the Sámi way of living, with an increasing interest for the exploitation of vast natural resources, which may in some cases be a controversial strategy even when motivated by geopolitics and an ongoing industry transformation to sustainability. This remains a sensitive balancing-act for policymakers and other stakeholders also at regional level. Maintaining a balanced and open dialogue between economic, social, and environmental dimensions of sustainability, while upholding international law, is at the core of Arctic development.

The effort by the EU JRC to encourage the European Arctic regions is a central channel for European stakeholders to pay more attention to sustainability in their Smart specialisation activities in Arctic regions. Smart specialisation for the SDGs is widening the traditional approach to incorporate sustainability explicitly. This widening crucially needs to go hand in hand with a deepening process: ensuring the formulation of high-quality Smart specialisation strategies consistent with all the fundamental tenets of the approach. This will allow more transferable and representative alignment of Smart specialisation with the Sustainable Development Goals and with the European Green Deal. In a nutshell, this report advocates a big step towards truly sustainable Smart specialisation and increased practical implementation of the 'S3 for SDGs' framework (European Commission, 2020a; Miedzinski et al., 2022).

In addition, the threat of climate change is a moving target and it is important to ensure adaptability and resilience in all sustainability policies and measures. One concrete way to ensure foresight and climate adaptation in Smart specialisation strategies is to connect local-level and regional level activity in the European Arctic to the Mission on Adaptation to Climate Change as proposed for the Horizon Europe programming period (see European Commission, 2020c).

Based on the analysis of sustainable development and Smart specialisation in Nordic Arctic regions, the authors of the present study propose the following recommendations for sustainable development embedded in Smart specialisation approaches in the European Arctic.

**First, we need to ensure that the Smart specialisation is comprehensively anchored in and across the Arctic.** This is a prerequisite to the successful embeddedness of sustainable development and Smart specialisation, to meet the EU's overarching ambition of sustainability, designing Smart specialisation strategies for sustainability and also for inclusiveness, wherein increasingly locally-driven Smart specialisation processes integrate regional innovation policy with aims and measures to advance sustainable development and the SDGs. The Smart specialisation concept needs to be communicated in a clear, understandable and relevant way to stakeholders in European Arctic regions – especially in regions where Smart specialisation strategy processes are still underway. This is a key step that needs to take place before the embeddedness of sustainability and Smart specialisation can be fully realised.

**Second, the launch and implementation of Smart specialisation has received an extra boost via the spread of the SDG framework.** The widely recognised S3 and globally legitimised SDG framework, easily transmitted to local-level challenges and action plans, should be leveraged in



further developing sustainable Smart specialisation processes for the European Arctic regions. This notably also includes the sub-regional level, where we already see examples of experimental yet successful S3 processes built up from sub-regional and community levels across the Nordic Arctic.

**Third, further incentives would be welcome in order to fully apply the embeddedness of sustainable development and Smart specialisation at regional level.** Funding authorities and the institutional framework play an important role in encouraging stakeholders to propose and implement projects promoting sustainable development integrated into Smart specialisation.

**Fourth, flagship projects, testbeds and good practice regional cases are important for engaging stakeholders to further develop embedded projects of sustainable development and Smart specialisation.** De facto Smart specialisation projects, i.e. flagship initiatives where stakeholders or regional councils collaborate in mutual regional strengths without a formalised Smart specialisation framework, will also provide important opportunities for promoting the integration of sustainable development and Smart specialisation in the European Arctic in the coming years. There are several such projects currently underway across the Nordic Arctic, particularly surrounding the sustainability transition of traditional industries, but also with respect to the synthesis between global industry and traditional sectors, such as in Norwegian coastal areas, and in areas used for Sámi reindeer husbandry. A more active sustainability innovation dialogue driven by regional and local stakeholders is clearly needed, as well as initiatives to encourage mobility across the Nordic Arctic e.g. in the field of green transition investments. Including the flagship projects more closely in the S3 for SDGs policy dialogue may help boost and inspire the policy agenda, but can also help ensure an equitable regional development trajectory that includes all stakeholder groups, beyond large corporations and research units.

**Fifth, inclusive measures are needed in the European Arctic to make the sustainable transition happen.** A broad view of innovation is needed, and the emphasis should not only lie on the larger cities but also on unlocking the full potential of the more remote localities within each region as well as including indigenous people as stakeholders. Moreover, flagship projects by big stakeholders should be complemented by grassroots initiatives, also including and showcasing the activities of young people. On the whole, the European Arctic needs to 'own' the process of embedding sustainable development and Smart specialisation – complementing regional leadership with the expert help of organisations such as the EU JRC and the full utilisation of the 'toolbox' of policy-methods provided by the Smart specialisation concept is recommended. This includes benefitting from the guidance and support services offered by the JRC S3 Platform.

**Sixth, there is a need to re-emphasise and expand efforts of interregional and transnational learning and collaboration in the European Arctic regions.** Several collaborative networks have been established, but they are yet to be fully utilised as a tool for transferring key insights and harmonising efforts in smart sustainable transitions. There is evident potential for scaling up these learning processes and forums: as this study has highlighted, regions are at different stages in these policy processes but share many of the same structures and challenges in common. In particular, many localities with new investments in sustainable industry projects are facing similar pressure and imbalance in their demographic structure, with a growing need for skilled labour in a variety of sectors. There is room for further collaboration across regions on meeting and mitigating these challenges as a united front, and increasing exchange opportunities.

**Finally, Smart specialisation processes have proven to be well adapted to pandemic recovery processes and resilient to the consequences of the invasion of Ukraine,** as these are developments of high uncertainty that demand the inclusion of strategies that are worked out at and for the local level. It has also been demonstrated that regional and broader innovation processes have received further encouragement following the need to meet the challenge of replacing Russian supply e.g. in European energy strategies.

Sustainable and inclusive Smart specialisation at regional level in the Arctic region, in today's highly uncertain times, provides an enormous opportunity not only for the European Arctic, but also for the EU, to plan, experiment and implement innovative place-based projects and processes enabling socio-economic recovery while strengthening territorial resilience to societal challenges. Mobilisation is key – strategies and plans pave the way for the future, but the mobilisation of regional and local-level stakeholders to implement the plans is the ultimate factor that will determine the success of the momentum that the recent sustainable Smart specialisation issues bring to the forefront of the European policy agenda. The pandemic period has resulted in a significant rise in the number of digital meetings, which has already increased cooperation across the Nordic Arctic.

## References

- Arctic Centre, University of Lapland. 2018. Arctic Indigenous Peoples. 28 June. Accessed October 10, 2020. <https://www.arcticcentre.org/EN/communications/arcticregion/Arctic- Indigenous-Peoples>.
- Arctic Agenda. 2020. Five. An introduction. Accessed 1 December 2020. <https://www.arcticagenda.org/>
- Barca, F. 2009. An Agenda for a Reformed Cohesion Policy. DG REGIO.
- Boschma, R. 2014. Constructing regional advantage and smart specialisation: Comparisons of two European policy concepts. *Italian Journal of Regional Science (Scienze Regionali)*, 51-68.
- Dubois, A., Kristensen, I., and Teräs, J. 2017. "Outsmarting Geography: Implementing Territorial Innovation Strategies in Sparsely Populated Areas." *European Planning Studies* 1316-1333.
- ELMO. 2019. East and North Finland Industrial transition: Smart specialisation strategy 2019-2023. ELMO project publication 2019. Accessed 10 October 2020. [https://issuu.com/ip-suomi.elmo/docs/elmo-strategy\\_english\\_web](https://issuu.com/ip-suomi.elmo/docs/elmo-strategy_english_web)
- European Commission. 2019. "Implementation of the Strategic Action Plan on Batteries: Building a Strategic Battery Value Chain in Europe." COM/2019/176. Accessed: 4 May 2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1554816272501&uri=COM:2019:176:FIN>
- European Commission. 2019a. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal. COM/2019/640 final. Accessed 10 October 2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019DC0640>
- European Commission. 2020. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. Europe's moment: Repair and Prepare for the Next Generation. COM/2020/456 final. Accessed 10 October 2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590732521013&uri=COM%3A2020%3A456%3AFIN>
- European Commission. 2020a. From S3 to S4: Towards Sustainable Smart specialisation Strategies. JRC Seville Newsroom. Accessed 10 October 2020. [https://ec.europa.eu/newsroom/jrcseville/item-detail.cfm?item\\_id=670313&utm\\_source=jrcseville\\_newsroom&utm\\_medium=Website&utm\\_campaign=jrcseville&utm\\_content=From%20S%20to%20S%20Towards%20Sustainable%20Smart%20Specialisation%20Strategies&lang=en](https://ec.europa.eu/newsroom/jrcseville/item-detail.cfm?item_id=670313&utm_source=jrcseville_newsroom&utm_medium=Website&utm_campaign=jrcseville&utm_content=From%20S%20to%20S%20Towards%20Sustainable%20Smart%20Specialisation%20Strategies&lang=en)
- European Commission 2020b. Smart specialisation Platform: Pilot Activity in Serbia. Accessed 10 October 2022. <https://s3platform.jrc.ec.europa.eu/pilot-methodology>
- European Commission 2020c. A climate resilient Europe. Prepare Europe for climate disruptions and accelerate the transformation to a climate resilient and just Europe by 2030. Accessed 20 December 2022. <https://op.europa.eu/en/publication-detail/-/publication/2bac8dae-fc85-11ea-b44f-01aa75ed71a1/language-en/format-PDF/source-search>
- European Commission 2021. Joint Communication: A stronger EU engagement for a peaceful, sustainable and prosperous Arctic. JOIN (2029) Final 27. Accessed 11 November 2022. [https://www.eeas.europa.eu/sites/default/files/2\\_en\\_act\\_part1\\_v7.pdf](https://www.eeas.europa.eu/sites/default/files/2_en_act_part1_v7.pdf)
- Finnmark Council Council 2019. Regional Innovation Strategy for Finnmark (RIS3) – based on SMART specialisation principles. Accessed 10 October 2022. [https://www.tffk.no/f/p1/ie4fe008e-8516-4beb-861d-843408b6bd75/regionale-innovasjonstrategi\\_engelsk.pdf](https://www.tffk.no/f/p1/ie4fe008e-8516-4beb-861d-843408b6bd75/regionale-innovasjonstrategi_engelsk.pdf)
- Flick H., Braun A., Örlýgsdóttir A., Hauksdóttir G. 2022. , The Implementation of the Sustainable Development Goals in the Nordic Arctic (ISDeGoNA) Report: 1-2022 NORCE, Division Health & Social Sciences.

Foray, D., Morgan K., and Radosevic, S., 2018. The role of Smart specialisation in the EU research and policy landscape. European Commission publication. Accessed 10 October 2020. [https://ec.europa.eu/regional\\_policy/en/information/publications/brochures/2018/the-role-of-smart-specialisation-in-the-eu-research-innovation-policy-landscape](https://ec.europa.eu/regional_policy/en/information/publications/brochures/2018/the-role-of-smart-specialisation-in-the-eu-research-innovation-policy-landscape)

Foray, D. and Van Ark, B. 2008. Knowledge for Growth: European Issues and Policy Challenges. Research Policy. European Commission publication. Accessed 10 October 2022. <https://op.europa.eu/en/publication-detail/-/publication/e46f80d7-abd0-446a-a4c2-2dbd61e71497>

Haeolus, accessed 4 Dec 2022. <https://www.haeolus.eu/>

Koivuova, T. and colleagues. 2021. Overview of EU actions in the Arctic and their impact. Accessed 4 December 2022. <https://eprd.pl/wp-content/uploads/2021/06/EU-Policy-Arctic-Impact-Overview-Final-Report.pdf>

Leino, J. and Hunter, A. 2020. Smart specialisation in the Baltic Sea Region – Learning towards Macro-regional Specialisation. Study carried out in the framework of the Interreg BSR S3 Ecosystem project, October 2020, Tampere. Accessed 1 December 2022. <http://www.pa-innovation.eu/wp-content/uploads/2019/09/BSR-Stars-S3-learning-for-BSR-S3-ecosystem-004.pdf>

LKAB. 2020. Historic Transformation Plan for LKAB. LKAB Press Release 23 November 2022. Accessed 1 December 2020. <https://www.lkab.com/en/news-room/press-releases/historic-transformation-plan-for-lkab-the-biggest-thing-we-in-sweden-can-do-for-the-climate/>

McCann, P. and Soete, L. 2020. Place-based innovation for sustainability. Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-20392-6, doi:10.2760/250023, JRC121271.

Miedzinski, M., Ciampi Stancova, K., Matusiak, M., Coenen, L. 2021. Addressing Sustainability Challenges and Sustainable Development Goals via Smart Specialisation. Towards a Theoretical and Conceptual Framework. Publications Office of the European Union, Luxembourg.

Miedzinski, M., Coenen, L., Larsen, H., et al., 2022. Enhancing the sustainability dimension in Smart Specialisation strategies : a framework for reflection : step-by-step reflection framework and lessons from policy practice to align Smart Specialisation with Sustainable Development Goals, Publications Office of the European Union, <https://data.europa.eu/doi/10.2760/300268>

Nakicenovic, N., Zimm, C., Matusiak, M., Ciampi Stancova, K. 2021. Smart Specialisation, Sustainable Development Goals and environmental commons. Conceptual framework in the context of EU policy., EUR 30882 EN, Publications Office of the European Union, Luxembourg.

NOAA. 2020. Arctic Report Card. Accessed 10 October 2022. <https://www.arctic.noaa.gov/Report-Card/Report-Card-2020>

Nordland County Council 2013 Innovative Nordland – Innovation Strategy for Nordland 2014-2020. Accessed 10 October 2020. [https://www.nfk.no/fp34/i83b99f70-1c31-4c7c-bf64-59e66b4bb567/innovation\\_strategy\\_web.pdf](https://www.nfk.no/fp34/i83b99f70-1c31-4c7c-bf64-59e66b4bb567/innovation_strategy_web.pdf)

Nordland Research Institute. 2020. Strekk i laget – en kartlegging av hvordan FNs bærekraftsmål implementeres i regional og kommunal planlegging (*mapping implementation of SDG in Norwegian regional and municipal planning*). Accessed 1 December 2020. [http://www.nordlandsforskning.no/getfile.php/1330579-1599055999/Dokumenter/Rapporter/2020/NF-rapport%2007\\_2020.pdf](http://www.nordlandsforskning.no/getfile.php/1330579-1599055999/Dokumenter/Rapporter/2020/NF-rapport%2007_2020.pdf)

Nordregio. 2016. Sustainable Business Development in the Nordic Arctic.

Northvolt. 2022. Accessed 10 October 2022. [www.northvolt.com/newsroom](http://www.northvolt.com/newsroom)

Nymand Larsen, J., and Fondahl, G. 2014. Arctic Human Development Report. Copenhagen: Nordic Council of Ministers.

OECD. 2017. OECD Territorial Reviews: Northern Sparsely Populated Areas. OECD Territorial Reviews, OECD Publishing, Paris. Accessed 10 October 2022. <https://doi.org/10.1787/9789264268234-en>

Paulson, D. 2019. Report on the implementation of Smart specialisation in Sweden. Tillväxtverket independent Expert Report. Accessed 10 October 2022. [https://tillvaxtverket.se/download/18.b316e7e16fa47c95ec58ee8/1579513697125/Report%20on%20smart%20specialisation%20final\\_%20\(002\).pdf](https://tillvaxtverket.se/download/18.b316e7e16fa47c95ec58ee8/1579513697125/Report%20on%20smart%20specialisation%20final_%20(002).pdf)

Rantanen, M., Karpechko, A.Y., Lipponen, A. et al. 2022. The Arctic has warmed nearly four times faster than the globe since 1979. *Commun Earth Environ* 3, 168.

Region Norrbotten. 2019. Smart Specialisering i Norrbotten. Accessed 10 October 2022. [https://www.norrbotten.se/publika/lg/regio/2020/smart\\_specialisering\\_200707\\_webb.pdf](https://www.norrbotten.se/publika/lg/regio/2020/smart_specialisering_200707_webb.pdf)

Region Norrbotten. 2020a. Regional Utvecklingsstrategi i Norrbotten 2030. Accessed 11 November 2022. <https://utvecklanorrbotten.se/uppdraget/regional-utvecklingsstrategi/>

Region Norrbotten 2020b. Kunskapsunderlag om Agenda 2030 och Region Norrbottens arbete. Accessed 11 November 2022. <https://www.norrbotten.se/globalassets/amnen/politik-och-demokrati/regionfullmaktige/sammantraden/2020/17-juni/kunskapsunderlag-om-agenda-2030-och-region-norrbottens-arbete.pdf>

Region Västerbotten. 2019. Regional utvecklingsstrategi för Västerbotten 2020–2030. Accessed 10 October 2022. <https://regionvasterbotten.se/naringsliv-och-samhallsbyggnad/regional-utvecklingsstrategi>

Region Västerbotten. 2019a. Regionala prioriteringar i Västerbotten – Analys. Region Västerbotten – regional utveckling. Accessed 10 October 2022. <https://regionvasterbotten.se/VLL/Filer/Regionala%20prioriteringar%20i%20V%C3%A4sterbotten%20ANALYS.pdf>

Regional Council of Lapland. 2018. Strategic Priorities for International and Smart Specialisation 2018-2022. Accessed 12 October 2022. <https://s3platform.jrc.ec.europa.eu/documents/20182/380920/Lapland+an+Arctic+and+international+highflier.pdf/4816f269-ca2f-4853-bb1a-4ecbbb7f981e>

Regional Council of Lapland. 2021. Lapland Agreement (Lappi-sopimus).

Seerri, accessed 4 December 2022. <https://seerri.eu/>

Sörlin, S. 2019 State and resources in the north: from territorial assertion to the “smorgasbord state”, pp 38-62 in E. Carina H. Keskitalo (ed) “The politics of Arctic resources – change and continuity in the “old north” of Northern Europe”, Oxon: Routledge.

TEM. 2020. Finnish Ministry of Economic Affairs and Employment. TEM Press release 14 October 2020.

Teräs, J., Salenius, V., Fagerlund, L., Stanionyte, L. 2018. *Smart specialisation in Sparsely Populated European Arctic Regions*, EUR29503 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-98266-8

Teräs, J., Dubois, A., Sörvik, J. and Pertoldi, M. 2015. Implementing Smart specialisation in Sparsely Populated Areas. EU Joint Research Centre.

Teräs, J. and Mäenpää, A. 2016. “Smart specialisation Implementation Processes in the North.” *European Structural and Investment Funds Journal* 75-86.

Troms and Finnmark County Council. 2022. Sammen om å skape sterke opplevelser. Reiselivsstrategi for Troms og Finnmark 2023-2032/*Tourism strategy for Troms and Finnmark 2023-2032*.

Tipping+, accessed 4 Dec 2022 <https://www.nordlandsforskning.no/nb/project/tipping>

Troms County Council. 2015. Arctic Innovation – R&D strategy for Troms. Accessed 10 October 2020. <https://docplayer.me/47175806-Arktisk-innovasjon-fou-strategi-for-troms.html>

UN Independent Group of Scientists. 2019. Global Sustainable Development Report. Accessed 10 October 2022. <https://sustainabledevelopment.un.org/gedr2019>

United Nations. 2015. Transforming our world: the 2030 Agenda for Sustainable Development. Resolution adopted by the General Assembly on 25 September 2015. A/RES/70/1. <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement>

United Nations. 2020. The Sustainable Development Goals Report. Accessed 10 October 2022. <https://unstats.un.org/sdgs/report/2020/>

Ylinenpää, H., Teräs, J. and Örtqvist, D. 2016. "Innovation Networks in Different Industrial settings: From Flexible to Smart specialisation." European Journal of Planning Studies 1-18.





## List of abbreviations

EC – European Commission

EDP – Entrepreneurial Discovery Process

EGD – European Green Deal

ESIF – European Structural and Investment Funds

EU – European Union

GDP – Gross Domestic Product

GHG – Greenhouse gas emissions

JRC – Directorate-General Joint Research Centre of the European Commission

NATO – North Atlantic Treaty Organisation

NSPA – Northern Sparsely Populated Areas

OECD – Organisation for Economic Co-operation and Development

R&D – Research and Development

R&I – Research and Innovation

RRI – Responsible Research and Innovation

S3 – Smart Specialisation Strategies

S4 – Sustainable Smart Specialisation Strategy

SDGs – Sustainable Development Goals

STI – Science, technology and innovation

TIP – Transformative innovation policy

UN – United Nations

## List of boxes

Box 1. Smart Specialisation strategies.....	22
Box 2. Key conclusions of the OECD NSPA Report.....	23
Box 3. Smart specialisation for the SDGs.....	25

## List of figures

<a href="#">Figure 1. The Nordic Arctic regions</a>	9
<a href="#">Figure 2. Resources in the Arctic Region</a>	13
<a href="#">Figure 3. Minerals and mines in the Nordic Arctic (source: Nordregio)</a>	14
<a href="#">Figure 4. Regional Innovation Scoreboard 2021</a>	16
<a href="#">Figure 5. Sustainable Development Goals</a>	18
<a href="#">Figure 6. Key components of the European Green Deal</a>	18
<a href="#">Figure 7. Kemi-Tornio Circular Economy platform in Lapland</a>	32
<a href="#">Figure 8. Synergies and collaboration areas listed in the Finnmark's regional innovation strategy</a>	46
<a href="#">Figure 9. Mapping hydrogen projects in North Norway</a>	51

## List of tables

Table 1. The Arctic regions in figures.....	10
Table 2. Summary of main development opportunities and challenges in the European Arctic.....	11

## **GETTING IN TOUCH WITH THE EU**

### **In person**

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online ([european-union.europa.eu/contact-eu/meet-us\\_en](https://european-union.europa.eu/contact-eu/meet-us_en)).

### **On the phone or in writing**

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696,
- via the following form: [european-union.europa.eu/contact-eu/write-us\\_en](https://european-union.europa.eu/contact-eu/write-us_en).

## **FINDING INFORMATION ABOUT THE EU**

### **Online**

Information about the European Union in all the official languages of the EU is available on the Europa website ([european-union.europa.eu](https://european-union.europa.eu)).

### **EU publications**

You can view or order EU publications at [op.europa.eu/en/publications](https://op.europa.eu/en/publications). Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre ([european-union.europa.eu/contact-eu/meet-us\\_en](https://european-union.europa.eu/contact-eu/meet-us_en)).

### **EU law and related documents**

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex ([eur-lex.europa.eu](https://eur-lex.europa.eu)).

### **Open data from the EU**

The portal [data.europa.eu](https://data.europa.eu) provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

## The European Commission's science and knowledge service

Joint Research Centre

### JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



**EU Science Hub**  
[joint-research-centre.ec.europa.eu](https://joint-research-centre.ec.europa.eu)



@EU\_ScienceHub



EU Science Hub - Joint Research Centre



EU Science, Research and Innovation



EU Science Hub



EU Science



Publications Office  
of the European Union