



NÆRINGS- OG FISKERIDEPARTEMENTET
KOMMUNAL- OG MODERNISERINGSDEPARTEMENTET
KLIMA- OG MILJØDEPARTEMENTET

Report

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Future North

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Final report from 'Knowledge Gathering –
Value Creation in the North'





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Foreword by the Ministries

This knowledge-gathering project is the outcome of the white paper 'First Update of the Integrated Management Plan for the Marine Environment of the Barents Sea–Lofoten Area' (Meld. St. 10 (2010-2011):

The Ministry of Trade and Industry, the Ministry of Fisheries and Coastal Affairs, the Ministry of Local Government and Regional Development and the Ministry of the Environment will develop knowledge of the direct and spin-off effects of expanding commercial activities such as tourism and fishery-related enterprises. The knowledge acquired will be useful for the next update of the management plan. [.....]

Knowledge Gathering – Value Creation in the North covers the three northernmost counties (Nordland, Troms and Finnmark) and focuses on coastal areas in particular. The subjects for the knowledge-gathering project were defined in consultation with local and regional authorities, as well as sectoral authorities, expert environments, business players and other affected parties.

The results from the knowledge-gathering project, which are presented in this final report, are based on comprehensive material gathered in the course of 13 studies, development of an economic model, an extensive scenario process and frequent contact

with representatives of the business community and government in Northern Norway. We wish to take this opportunity to thank everyone who contributed to the knowledge-gathering project.

The report was produced by the project secretariat on behalf of the project steering group with the exception of chapter 2, which was written by Peter Arbo of the University of Tromsø. The introductions to each chapter were written by Kriss Rokkan Iversen of SALT.

It is our hope that the overall result will be used for the further development of plans and policy instruments with a view to boosting value creation in Northern Norway, at a local, regional and central level.

The final report and various studies are available on the Ministry of Trade, Industry and Fisheries website. Stakeholders can submit ideas and comments regarding the final report. Any comments regarding the knowledge-gathering project should be sent to the Ministry of Trade, Industry and Fisheries by 31 July 2014.

*Ministry of Trade, Industry and Fisheries
Ministry of Local Government and Modernisation
Ministry of Climate and Environment*

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Summary

Photo: Øystein Lunde, www.nordnorge.com, Bø. Sculpture: The Man from the Sea, Kjell Erik Killi Olsen



In Knowledge Gathering – Value Creation in the North

the Ministry of Trade, Industry and Fisheries, the Ministry of Climate and Environment, and the Ministry of Local Government and Modernisation take a detailed look at the opportunities for growth in selected industries in Northern Norway. The industries were chosen on the basis of the original commission in the white paper Meld. St. 10 (2010-2011), i.e. tourism and fishery-related enterprises, supplemented by two resource-based industries, renewable energy and minerals, which have aroused expectations with a view to increased growth in Northern Norway.

The overarching problems were as follows:

- What is the potential for future value creation within the marine industries (seafood), tourism, renewable energy, the mineral industry, and other industry and business in Northern Norway? What will this mean for future employment in the industries in question?
- What is needed to realise the potential for value creation? What are the most important challenges and how can they be dealt with? What are the most effective policy instruments for providing a framework for profitable growth?
- What might Northern Norway be like in 2030, looking ahead to 2060?

The problems were explored using several different tools and methods, including:

- Sectoral analyses charting the selected industries, including their potential for future value creation and employment

- Cross-sectoral analyses looking at the challenges facing several industries, e.g. access to competent labour, innovation and infrastructure
- A scenario process for drawing qualitative pictures of what Northern Norway may be like in 2030 given development in uncertain driving forces, such as the scope of petroleum activity, the development of climate policy globally and the development of competence and innovation in the region.
- Qualitative and quantitative assessments of policy instruments. These last analyses were carried out using a macro-model for the regional economy developed as part of the project. Among other things, they look at the regional effects of both central and local policy instrument use, and how growth in one industry affects the development opportunities for other industries.

The knowledge-gathering project is based on the assumption that value creation must be sustainable. This means taking account of the economic, social, cultural and environmental aspects of value creation, and balancing these considerations in a way that secures the objectives of economic growth, social development and care for the environment. Sustainable growth must provide greater welfare and improved quality of life, while looking after and improving our basis for life in the long term.

Commercial activity impacts on the external environment by exploiting nature's bounty and harvesting natural resources. If insufficient account is taken of the environmental challenges this entails, the industries

may impair/weaken the basis for their own activities in the longer term.

Current status and future prospects of the industries

In order to assess future potential for value creation in selected industries in Northern Norway, it was necessary to survey the status quo. The knowledge-gathering project collected data on business as it stood in 2011 by means of five sectoral analyses, placing special emphasis on financial key figures such as turnover, value creation and employment.

In 2011 the sectors analysed in the project accounted for a good 60% of total value creation (in terms of gross product) and a good 50% of employment in Northern Norway. The remaining value creation and employment are accounted for by the public sector. Northern Norway's share of value creation in Norway is particularly high in marine industries, minerals and renewable energy. Value creation in the tourism industry also makes up a larger proportion of total business in Northern Norway than in the rest of the country, while the counties of Northern Norway provide a relatively small proportion of national production of private services and other industry.

Mean value creation per employee in Northern Norway was NOK 681,000 in 2011. By way of comparison, mean value creation per employee in the country as a whole was NOK 816,000 in the same year. There are large variations in value creation per employee in the different sectors in Northern Norway, from NOK 2.2 million in renewable energy to around NOK 0.5 million in the tourism industry. The differences are not simply due to renewable energy being a more profitable industry, but are also the result of very low labour intensity combined with high capital intensity in renewable energy, while the opposite is the case for the tourism industry.

Marine industries

The sea areas off Northern Norway are among the most productive in the world and provide a large resource base, which includes some of the world's largest fish stocks. Northern Norway also offers good

conditions for aquaculture, and by-products from both fisheries and aquaculture are important input factors in the marine ingredients industry.

The marine industries comprise fisheries, aquaculture, new marine industries, fish processing, the biomarine industry and the supplier industry. In 2011 these industries had total turnover of NOK 28.7 billion. The highest turnover figures were posted by aquaculture with NOK 10.3 billion and fish processing with NOK 10.8 billion.

Total value creation in the sector in 2011 was NOK 10.3 billion. Mean value creation per employee for the marine industries as a whole was NOK 920,000 in 2011. Value creation in the marine industries increased from NOK 6.4 billion to NOK 10.3 billion in the period 2008-2011, equivalent to real growth of approximately 52%. Payroll costs rose 39% in the period, while employment was stable with virtually zero growth. The increase in value creation in the sector is primarily due to increased volume in the aquaculture industry and price levels. Value creation in both fisheries and aquaculture can vary widely from year to year owing to price fluctuations.

Total employment in the marine industries in Northern Norway in 2011 was approximately 11,200 people. The fishing industry employed the largest number, 4,600, followed by fish processing with close to 3,900 employees. We find the smallest number of employees in the new marine industries. Between 2005 and 2011 the total number of employees in fisheries and fish processing fell sharply in some cases, while the number of people employed in aquaculture went up.

Tourism

Northern Norway's spectacular scenery is by far and away the region's most valuable tourism resource. Northern Norway has an abundance of nature: mountains, high plateaus, sky and coast, and world-class natural phenomena like the midnight sun and northern lights. Northern Norway's local communities and culture also play an important role as mainstays of the tourism industry. Arctic, coastal and, not least,

Sami culture provide a framework for the nature experience, making it more unique and complete.

The tourism sector is made up of enterprises supplying accommodation, catering, transport, experiences and agency services. In 2011 these industries had total turnover of NOK 14.4 billion in Northern Norway. Transport is by far the biggest industry, accounting for 56% of turnover in 2011. Accommodation accounted for 18%, catering for 13%, experiences for 8% and agency services for 5%.

Value creation in tourism in Northern Norway was NOK 6.2 billion in 2011. Mean value creation per employee for tourism as a whole was just under NOK 520,000 in 2011. The distribution of value creation between the various industries is similar to that for turnover. Growth in value creation in Northern Norway was 19% between 2005 and 2011, which is somewhat lower than for tourism in the country as a whole, where growth was 27% in the same period.

There were 11,900 people employed in tourism in Northern Norway in 2011, as against just under 14,100 in 2005. This fall is primarily due to improved efficiency. The transport industry experienced the largest fall with 30%, while employment in the experience industry rose by 38%.

Renewable energy

There is a lot of energy in Northern Norway's weather, with waterfalls and wind in abundance, but also waves, tides, thermal power and sun. Renewable energy production is based on converting the energy contained in various renewable natural resources into usable energy such as electricity or heat.

Renewable energy includes electricity, heat production and potential fuel production. The sector is made up of hydropower, wind power, tidal and wave power, solar energy, thermal energy, electric power transmission and energy sales. Hydropower is currently by far and away the dominant energy source, but land-based wind power has the greatest potential in the

medium term. Turnover for the sector was close to NOK 17 billion in 2011.

Value creation in the renewable energy sector in Northern Norway was NOK 6 billion in 2011. Mean value creation per employee was approximately NOK 2.2 million. A total of 71% of value creation came from companies generating hydroelectricity, while 24% came from power distribution companies. Growth in value creation was good, slightly more than doubling between 2004 and 2011.

The sector employed a good 2,700 people in 2011, nearly all of them in companies producing, distributing or selling hydroelectricity. Nordland also had considerable employment in solar energy in 2011, but almost all these jobs disappeared when REC closed down its operations in the county.

Mineral industry

Northern Norway is a key region for the Norwegian mineral industry, which comprises the extraction and production of metal ores, industrial minerals, natural stone and building materials. Ores and industrial minerals are of greatest importance to business and value creation in Northern Norway. The mineral industry had turnover of approximately NOK 2.6 billion in Northern Norway in 2011.

Total value creation in the mineral industry in 2011 was NOK 1.1 billion. Mean value creation per employee was approximately NOK 860,000. Value creation was made up of NOK 811 million from metal ores, NOK 190 million from industrial minerals, NOK 9.5 million from natural stone and NOK 101 million from building materials. Value creation from metal ores is concentrated on two mining operations in Nordland and Finnmark (Rana Gruber and Sydvaranger), while industrial minerals are more widely distributed in the region.

Close to 1,300 people were employed in Northern Norway's mineral industry in 2011. Employment is highest in Finnmark and Nordland, with these two

counties accounting for 75% of all full-time equivalents in Norway in ore production and 39% of all full-time equivalents in industrial mineral production in 2011.

Other industry and business

The other industry and business sector is made up of very different industries of varying size. It is divided into eight industries and a miscellaneous category. The eight industries are trade, building & construction, maritime & petroleum, industry, knowledge-intensive business services, culture, logistics & transport, and finance. The sector mainly provides local services, but with some exports. Regional demand is therefore an important growth factor.

A total of 98,000 people are employed in enterprises in the other industry and business sector. Value creation from the sector is not quite NOK 62 billion. The sector accounts for 78% of employment and 72% of value creation in the private sector in Northern Norway. Trade, building & construction and miscellaneous are by far the largest industries in this sector in terms of value creation and number of employees.

Projections

The sectoral analyses produced a quantified assessment of future value creation in the various sectors in Northern Norway in 2030 and 2050 for two different scenarios:

1. Possible development if today's framework conditions continue (reference scenario)
2. Possible development given optimum conditions, with all policy instruments/measures being implemented and uncertain driving forces turning out favourably for the industries

The assessment of future potential was carried out using slightly different assumptions and by different expert environments, but is largely based on the situation in the industries in 2011, and the trends and driving forces identified as most important for development in the different sectors. These projections do not take account of restrictions, such as access to labour. It is not possible, therefore, to tot up potential value creation in the various sectors, and strong growth in one of the sectors might have a negative impact on development possibilities in other industries.

Projection of value creation in the sectors (contribution to GDP, NOK millions)

	STATUS QUO	CURRENT POLICY		FULL IMPLEMENTATION	
	2011	2030	2050	2030	2050
Fisheries, aquaculture and new marine	10,258	21,000	39,000	45,000	170,000
Tourism industry	6,188	8,500	11,200	10,700	13,400
Renewable energy	6,000	10,000	16,200	10,600	19,700
Mineral industry	954	1,900	1,900	4,200	6,000
Other industry and business	62,621	92,800	125,000	143,200	175,000*

* The sectoral analysis of other industry and business does not quantify value creation and employment in the "Full implementation" alternative in 2050. In this table these figures have been projected using the same absolute growth in the period 2030-2050 as for "Current policy".

Projection of employment in the sectors

	STATUS QUO	CURRENT POLICY		FULL IMPLEMENTATION	
	2011	2030	2050	2030	2050
Fisheries, aquaculture and new marine	11,269	14,600	17,100	23,900	57,700
Tourism industry	11,901	12,400	10,160	14,000	11,800
Renewable energy	2,724	.*	-	-	-
Mineral industry	1,205	1,500	1,000	3,400	3,000
Other industry and business	98,093	106,900	96,800	161,100	145,900

* The sectoral analysis of renewable energy did not project employment figures, but has the following to say about labour needs in the sector: "Most forms of renewable energy do not require much labour input relative to the total labour requirement in the economy once the facilities have been commissioned. (...) The effect on employment may be slightly larger during expansion, but it is not certain that this labour requirement can be met exclusively by local labour. (...) There is probably potential for increased employment connected with the use of renewable energy, e.g. owing to the expansion of more power-intensive industry."

Boosting value creation – challenges and policy instruments

The business sectors looked at in the knowledge-gathering project have good possibilities for increasing their value creation if the conditions are put in place. The knowledge-gathering project examined the different sectors' building blocks for value creation and business development. There is great resource potential in the form of rich fish stocks, clean and productive seas, unique nature and natural phenomena, minerals, and plenty of sea and precipitation for use in energy production. The knowledge-gathering project also shows that challenges are involved in other building blocks, such as access to labour, education and competence, research and innovation, and infrastructure. These are general challenges faced by the sectors that could prevent them from realising their full value creation potential.¹

The knowledge-gathering project looks at whether appropriate policy instruments are available for meeting and tackling the various challenges, and at the possible impact of using them. The project also looks at the impact of selected sector-specific policy

¹ It must be stressed that the sectors are very different, while the region of Northern Norway is very large in purely geographical terms. A more industry-specific approach will therefore be needed in some areas to describe the challenges with sufficient nuance (see sector analyses).

instruments, and the effects of combining several types of policy instrument in so-called packages. The effects on value creation and employment were calculated for a large proportion of the relevant policy instruments using the NOREG economic model, which was developed as part of the knowledge-gathering project. The effects were measured as a deviation from the reference scenario, i.e. expected development in the economy given current policy instrument use. This reference scenario is as close as possible to the reference scenario for the Norwegian economy presented in the Ministry of Finance's white paper 'Long-term Perspectives on the Norwegian Economy' (Meld. St. 12 (2012-2013)).

Labour

The need for labour in Northern Norway will increase considerably in the years up to 2030, and it will be a challenge for the region to find sufficient people to boost value creation. Owing to low organic growth, labour will have to be recruited from other parts of Norway or abroad, but even with high immigration, labour force growth will be inadequate. Consequently, there will be shortages and competition for Northern Norway's labour force, with the industries that can offer the best pay and conditions being most successful when it comes to recruitment.

In order to increase labour force growth in the region, people-oriented policy instruments may be just as important in terms of total value creation in the region as industry-oriented or sector-specific policy instruments. Such instruments aim to strengthen population development by limiting emigration and/or increasing immigration to the region. Relevant measures include financial incentives such as measures that boost income and/or compensate for expenses, or labour market measures and measures aimed at increasing the attractiveness of towns and rural areas in a broader sense.

The individual measures cannot be modelled in NOREG, but it is possible to calculate what increased immigration might mean for value creation, i.e. how big the impact of managing to make it attractive to remain or settle in Northern Norway will be. If Statistics Norway's alternative with high immigration is used instead of the middle alternative (which is used in the reference scenario), we would see immigration helping to increase the number of people in employment in the region by 6% in 2030 and by more than 25% in 2060 compared with the reference scenario. Immigration has a major impact on value creation in both Northern Norway and Norway as a whole, because more productive resources are brought into play. It is the labour-intensive industries in particular that see strong growth.

Competence and education

It will be a challenge for business in Northern Norway to find labour with the right competence, especially when it comes to skilled workers with higher vocational qualifications. The fact that competence levels are lower than in the rest of the country when it comes to higher education will also be a challenge for business in Northern Norway. The relative deficit in formal higher education applies to all sectors and industries in Northern Norway, but especially the private sector, where the proportion of employees with higher education is just half that in the rest of Norway.

If we assume that productivity increases with competence, competence-raising measures targeted at the available labour force in Northern Norway would help

to increase productivity and with it value creation in Northern Norway. Such measures can be implemented in a number of areas and at different educational levels. They should include measures that increase the probability of pupils completing upper secondary school by, for example, making curriculums more practical and expanding the range of vocational courses *able to increase the number of school leavers with vocational qualifications*. In the case of higher education they might include increasing admissions. If the expansion of education capacity is better tailored to the needs of business and the public sector, productivity will probably grow faster than if the educational level is raised more generally.

NOREG was used to calculate the impact of enhancing educational level, with the proportion of the labour force with high education gradually increasing to 60% in 2030 and then holding steady. The cost of achieving this was calculated at NOK 6 billion a year, and it is assumed that a disproportionately large share of this bill will have to be borne by Northern Norway in order to compensate for the lower educational level in the region. The impact in Northern Norway will be considerable, with growth in value creation of 7% in 2030 and 6-7% in 2060. This prioritisation will also contribute to a sharp increase in employment in the region.

Research and innovation

Compared with the rest of the country, Northern Norway has less prioritisation of research and development overall, although there is considerable variation within the region. The decentralised structure of settlement and industry with few strong centres of expertise will make it especially challenging to create interfaces between business and business-oriented research. There is also a trend towards R&D investments falling in Northern Norwegian business, while they are increasing overall in Norwegian business. If this trend continues, it will reduce the innovative capacity of enterprises in Northern Norway and opportunities to develop new products, services and processes. Less prioritisation of research and development in Northern Norwegian business will also result

in enterprises being less able to obtain and benefit from public research funding.

Cooperation on innovation through innovation networks, for example, will have obvious benefits for business in Northern Norway. Close contact with others generates ideas and economies of scale in the case of joint knowledge development. Facilitating such cooperation initiatives may involve public funding and creating interfaces. This can be done using the smart specialisation model, for example, which aims to improve interaction between business, R&D environments and the authorities, with regional requirements and business development benefits controlling strategies and priorities. It may also be expedient to target applied research to a greater extent than is currently the case through increased cooperation between research institutions and business. The return on R&D is uncertain by its very nature, which is one reason why the authorities should fund a large proportion of research even if it is business oriented.

Calculation of the impact of increased prioritisation of R&D using NOREG was based on the Norwegian Government's target that 3% of GDP should be spent on R&D in 2030, in other words nearly twice the current figure. In the simulation, public expenditure on R&D is increased by 1.5% of GDP, with a real return of 8%, which is what is achieved in the SkatteFUNN tax deduction scheme. The increased expenditure is targeted disproportionately at R&D jobs in Northern Norway, but the impact on productivity is felt throughout the country. The impact in Northern Norway is relatively large in the long term, with value creation increasing by approximately 3% in 2030 and approximately 5% in 2060 compared with the reference scenario. The impact is much greater in Northern Norway than for the country as a whole, which indicates that much of the increase in value creation is due to the region receiving a relatively large proportion of the expenditure and jobs.

Infrastructure

One of Northern Norway's challenges is its geographical location, far from the large national and global

markets where the goods produced are in demand. Several industries are affected by limitations in the capacity and standard of infrastructure. The marine industries have transport needs in that they have to both send out large quantities of products and bring in input factors, a problem that is exacerbated by the decentralised location of enterprises and remoteness from international markets. In the case of tourism poor accessibility, especially in aviation, is an obstacle to attracting more tourists to Northern Norway. The Lofoten and Helgeland areas are the spearheads of the region's commitment to tourism, but neither has a main airport where large planes can land. Internal communications and accessibility in Northern Norway are also important in view of the increasing need for labour in the region. Enlarging the labour market regions and improving internal transport in the region may make it more attractive to live and work in Northern Norway by creating more flexible labour markets and service provision. However, the large distances mean that the potential for labour market enlargement is limited.

Greater prioritisation of infrastructure will mean investing in the improvement and renewal of infrastructure, while earmarking funds for operation and maintenance. There are a number of transport infrastructure measures that can boost value creation in Northern Norway.

- As far as the *road network* is concerned, the priority must be improvements that increase the predictability of transport, and the implementation of maintenance measures with a view to clearing the considerable backlog that has built up on both national and county roads. The E6, the roads connecting Norway and Sweden, and several of the ferry links are especially important.
- As regards the *ports*, it is important to develop the node function of the trunk network ports in the region, especially of those ports with rail links, making intermodal transport corridors possible. This will be an important measure in terms of establishing more sustainable transport solutions.

- When it comes to the *railways*, the capacity of the Ofoten Line should be increased, while the quality of the Nordland Line should be improved by introducing remote traffic management and generally upgrading the track.
- With regard to *airport structure*, the establishment of larger airports in Helgeland and Lofoten will be a key factor in enabling business in these areas to increase value creation. Hammerfest also needs a larger airport owing to the considerable potential for value creation offered by petroleum production in the Barents Sea.

To illustrate the importance of increased investment (and operation) in infrastructure measures, a calculation was carried out in NOREG, in which NOK 3 billion is invested in roads in Northern Norway, divided pro rata based on county size in terms of value creation. These investments make a considerable impact on the region. Value creation is 2-3% higher in 2030, and 4-5% higher in 2060. Nationally, the impact is very small, illustrating that this investment measure is small on a national scale.

Sector-specific policy instruments

The aquaculture, renewable energy and mineral industries are all subject to the same requirement that the quantity of resources they can exploit is controlled by concessions and licences. In the case of these industries it is therefore possible to increase value creation by granting more concessions, provided that exploitation is sustainable. As far as tourism is concerned, it is possible to tailor measures specifically targeted at value creation in the industry.

Increased growth in aquaculture

In the short and medium term, policy definition with regard to licensing and maximum permitted biomass in the sea (MPB), for example, will be key to growth and its distribution. An impact calculation was carried out in NOREG for "full implementation" from the sectoral analysis for the marine industries, with new areas being opened up and the number of concessions increased.

Full implementation would result in value creation being twice as large in 2013 as if current development had continued, and five times as large in 2060. This produces a not insubstantial increase in total value creation in Northern Norway, but not compared with value creation in the aquaculture industry. This means that a strong brake is being applied to total value creation as a result of the aquaculture industry feeding on the activity of other industries (displacement effect).

Increased prioritisation of tourism

The sectoral analysis for tourism suggests a number of policy instruments for boosting value creation in the industry, but only the tripling of funds for *destination development*, the establishment of a *charter fund*, and new airports in Lofoten and Helgeland (Mo i Rana) were modelled. The increase in GDP in the counties of Northern Norway and nationally as a result of such prioritisation is marginal, however. This is because the prioritisation of tourism will have major displacement effects on other industries, probably in consequence of the industry being relatively labour intensive and taking labour from other sectors.

Increased expansion of renewable energy

Based on the estimates in the sectoral analysis for the renewable energy industry, the NOREG simulation of growth in this sector assumed that value creation in the industry would almost double between 2011 (NOK 6 billion) and 2030 (NOK 11 billion), and double again by 2050 (NOK 20 billion). The outcome is marginal growth in total value creation in Northern Norway in the years to 2030, but somewhat larger growth in the longer term. Here too much of the increase in value creation is eaten up by a displacement effect.

Increased extraction of minerals

The mineral industry is very small in national terms. To all intents and purposes this means that the impact of increasing production in the industry on GDP at both county and national level will be small. As with the other industries, prioritising the mineral industry in isolation produces a displacement effect, with more labour-intensive industries being drained of resources.

Combined policy instruments

Calculating the effects of stimulating individual industries reveals that these industries will grow at the cost of other industries. This happens as long as it is assumed that labour is limited and the productivity of the input factors grows at the same rate as in the reference scenario used in 'Long-term Perspectives on the Norwegian Economy'. However, the simulations of increased access to labour, or more productive labour resulting from prioritisation of education and R&D, show that this can have a relatively large impact on value creation. It is therefore of interest to look at combinations of stimulating business at the same time as prioritising education and R&D or increased immigration.

Increased prioritisation of aquaculture with increased immigration

A combination of increased prioritisation of aquaculture and increased immigration produces far-reaching and much larger effects than purely prioritising aquaculture. Essentially, these measures operate independently of each other. Increased prioritisation of aquaculture has a small impact on the labour market, as it is not a very labour-intensive industry. Increased immigration helps equalise the displacement effect that would be produced by prioritising aquaculture in isolation. Equivalent simulations were not carried out for the other industries, but there is reason to assume that the effects would be similar, i.e. reduction or equalisation of the displacement effects.

Increased prioritisation of aquaculture with increased R&D and education

On the one hand, increased prioritisation of aquaculture combined with broad-based prioritisation of R&D and education will put the aquaculture industry into competition with public services for access to labour, but, on the other hand, increased prioritisation of R&D will help to increase productivity in the aquaculture industry. The latter means that value creation is somewhat larger in the aquaculture industry than in the straightforward aquaculture simulation, while combined prioritisation does not displace other business to the same extent. Increased productivity means that

value creation per employee increases, so not as many people will be needed to carry out the same tasks.

Prioritisation of tourism with increased R&D and education

Increased prioritisation of the tourism industry combined with increased prioritisation of R&D and education helps increase value creation by 3-6% in 2030 and 2060 compared with the reference scenario. Virtually all of this increase is due to the growth generated by increased R&D and education. The additional increase produced by the tourism measures is marginal, as the displacement effects are relatively large. The tourism industry becomes slightly more productive as a result of increased R&D, but because it is not very education intensive, it will not benefit much from education, and because it is labour intensive the measures will contribute to displacement from other labour-intensive industries.

Increased prioritisation of tourism and aquaculture with increased R&D and education

The final combined analysis includes increased prioritisation of aquaculture, tourism, R&D and education. As with the previous analyses, combining policy instruments will counteract the displacement effects to some extent. Compared with the total contribution to growth from the tourism analysis and the straightforward aquaculture analysis, the combined analysis produces higher value creation in Nordland, but slightly lower value creation growth in the other two counties. In general it seems that the overall impact on value creation is positive with such a combination of policy instruments.

Significance of uncertain driving forces

The scenario process identified three key uncertain driving forces that, depending on the direction of their impact, could affect future value creation in Northern Norway. The driving forces in question are:

- Will there be willingness to introduce international *climate policy* regulations?
- How extensive will *petroleum activity* in the north be?

Effects on value creation in the counties (GRP) and Norway as a whole (GDP) of different policy instruments. Percentage deviation from reference scenario.

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Policy targeted at one industry								
Aquaculture	2.9%	10.5%	1.9%	6.6%	2.4%	7.9%	0.2%	0.7%
Tourism	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Minerals	0.7%	0.7%	0.1%	0.1%	1.0%	1.0%	0.0%	0.1%
Renewable energy	0.8%	2.9%	0.2%	0.8%	0.6%	2.1%	0.0%	0.1%
Broad-based policy								
Increased immigration	2.7%	9.6%	3.0%	12.7%	2.5%	10.2%	3.0%	13.3%
More infrastructure in the region	3.0%	4.4%	2.4%	4.1%	3.1%	4.7%	0.1%	0.3%
Increased education	7.0%	6.4%	7.4%	6.8%	6.8%	6.1%	2.4%	2.5%
Increased R&D	3.0%	5.1%	2.8%	5.2%	3.2%	5.3%	0.3%	1.2%
Combination of policy instruments/policies								
Aquaculture with increased immigration	5.8%	20.0%	5.1%	19.1%	5.1%	17.8%	3.2%	13.8%
Aquaculture with increased R&D and education	6.2%	14.1%	6.4%	11.8%	6.1%	12.0%	3.0%	4.7%
Tourism with increased R&D and education	3.6%	3.8%	4.7%	5.4%	3.9%	4.1%	2.9%	4.0%
Minerals with increased R&D and education	4.0%	4.2%	4.5%	5.1%	4.8%	4.9%	2.0%	4.0%
Renewables with increased R&D and education	5.2%	9.7%	4.9%	6.8%	5.1%	8.4%	2.9%	4.3%
Aquaculture and tourism with increased R&D and education	6.9%	14.7%	6.4%	11.1%	5.6%	9.8%	3.0%	4.7%

- How will the attitude to *knowledge and innovation* develop in Northern Norway?

An attempt was made to model the results from the scenario process by carrying out quantitative model analyses of the significance of the uncertain driving forces. The effects of increased prioritisation of knowledge and innovation have already been discussed

above. Quantitative model analyses were also carried out in order to take a closer look at how stricter climate policy and increased petroleum activity might affect the economy of Northern Norway.

Future prospects for Northern Norway

Predicting what will happen in the future is a difficult, not to say impossible, task. The purpose of the future

prospects is primarily to provide a basis for what can or should be done in order to realise the potential for business development that exists, but will not necessarily materialise by itself. The knowledge-gathering project approached the future using several methods, but none of them gives the final word on future value creation. By looking at them in connection with each other, however, we can form a better basis for assessing future development.

The sectoral analyses provide pictures of the individual industries and simple projections of the possibilities for increased value creation by analysing the status quo in the industries and pointing to framework conditions, measures and important drivers for future development. The primary purpose of these projections is to explore the potential for each individual industry. They also have their limitations in that they are partial and do not take the big picture into account.

The economic model takes account of the big picture and some fundamental interrelationships in the economy, such as access to resources and other restrictions. The projections of the industry-oriented prioritisations clearly show that one-sided prioritisation of a single industry will be positive for that industry, but at the same time produce major displacement effects for other industries and so have little overall impact on either the regional or national economy. If, however, these prioritisations are combined with policy instruments that either increase access to resources (such as labour immigration) or make the resources more efficient (such as increased education and R&D), there will be synergy effects that benefit many industries.

The scenario process also takes an integrated approach, but qualitative rather than quantitative. The results of a scenario process go beyond the qualitative pictures of

the future. The actual process, involving many different business players, is in itself an important and hopefully instructive arena. Giving the players who take part a better basis for drawing up strategies and planning for the future is an important object. The pictures of the future are well suited to discussing the big picture, where the different industries can be seen together, and where it is also possible to appreciate more fundamental changes in the economy and framework conditions than a model can handle. The pictures of the future can also say something about the scope for business development in Northern Norway.

Knowledge Gathering – Value Creation in the North was given the mandate of investigating and visualising the possibilities for increased future value creation in key industries in Northern Norway. It took a detailed look at important input factors, current activity, the most important challenges, and the policy instruments and prioritisations that might be used to deal with the challenges and provide a framework for growth. All the methods used to look into the future show that there is considerable potential for increased value creation in Northern Norway, but also that such growth will not happen by itself. In order to boost value creation and make it more attractive to live and do business in Northern Norway, efforts will be required from national, regional and local players, the public sector and, not least, the business players themselves. The knowledge-gathering project tries to say something about what the scope is and what effects different prioritisations might lead to, not what the actual road ahead is. It is nevertheless hoped that the knowledge-gathering project will help to improve the decision-making basis for the choices that have to be made, and that active use will be made of the project's overall result in the ongoing work to generate increased value creation and good communities in Northern Norway.

1

Introduction

Photo: Espen Mortensen, esmofoto.no, www.nordnorge.com, Moskenes

In the beginning the ice created the land. Hidden beneath three kilometres of ice, sharp mountains and sheltered valleys took shape. Then, rugged, weathered, the land in the north rose forth above the sea. Where land met sea, where mountain met wave, the coastline took shape. A coastline that could girdle the earth itself. A coastline that offered caves, headlands and bays for settlement. A coastline that gave access to fabulous resources – both on land and at sea. Where deep-blue mountains, chalk-white beaches and gold-sprinkled cloudberry bogs lay swathed in northern lights and midnight sun. Off the coast the sea boiled in a silvery profusion that invited kittiwakes and minke whales to frolic. Fresh spring water found its way down the mountain-sides and out to the sea through green meadows. Sheltered by the mountains, the rich soil gave nourishment to edible plants – side by side with valuable rocks. And the sea. The sea concealed other treasures for ages to come. In its winds, tides and waves. In the seabed itself. And in wide open spaces with room for new thoughts and ideas.

Kriss Rokkan Iversen

Northern Norway is rich in natural resources, and there is potential for increased value creation in industries based on those resources. The marine industries are of world class, unique nature experiences provide a basis for tourism, the renewable energy resources are substantial and varied, and the mineral resources are plentiful. Good, sustainable management of these resources will help to provide a firm foundation for business development and economic growth, not just in the aforementioned industries, but also in supplier and service industries. The exploitation of these natural resources will require competent people who find it attractive to remain in, or relocate to, Northern Norway.

In *Knowledge Gathering – Value Creation in the North* the Ministry of Trade, Industry and Fisheries, the Ministry of Climate and Environment, and the Ministry of Local Government and Modernisation¹ take a detailed look at the possibilities for growth in selected industries with the main emphasis on marine industries and tourism.

The overarching problems discussed in this report are as follows:

- What is the potential for future value creation within the marine industries (seafood), tourism, renewable energy, the mineral industry, and other industry and business in Northern Norway? What will this mean for future employment in the industries in question?
- What will it take to realise the potential for value creation? What are the most important challenges

¹ The Ministry of Trade and Industry, the Ministry of Fisheries and Coastal Affairs, and the Ministry of Local Government and Regional Development prior to 1 January 2014.

and how can they be dealt with? What are the most effective policy instruments for providing a framework for profitable growth?

- What might Northern Norway be like in 2030, looking ahead to 2060?

A long time frame was chosen, in part to reveal differences between industries based on renewable and non-renewable natural resources. With sustainable management, renewable resources can be harvested and exploited indefinitely.

The problems were explored using several different tools and methods, including:

- Sectoral analyses charting the selected industries, including their potential for future value creation and employment.
- Cross-sectoral analyses looking at the challenges facing several industries, e.g. access to competent labour, innovation and infrastructure.
- A scenario process for drawing qualitative pictures of what Northern Norway may be like in 2030 given development in uncertain driving forces, such as the scope of petroleum activity and the development of climate policy globally.
- Qualitative and quantitative assessments of policy instruments. These last analyses were carried out using a macro-model for the regional economy developed as part of the project. Among other things, they look at the regional effects of both central and local policy instrument use, and how development in one industry affects the development opportunities for other industries.

Throughout the knowledge-gathering project importance was attached to rooting the work locally through the active participation of affected players in Northern Norway.

1.1 Background: Integrated Management Plan for the Barents Sea-Lofoten Area

The knowledge-gathering project was initiated in the white paper 'First Update of the Integrated Management Plan for the Marine Environment of the Barents Sea-Lofoten Area' (Meld. St. 10 (2010-2011)):

The Ministry of Trade and Industry, the Ministry of Fisheries and Coastal Affairs, the Ministry of Local Government and Regional Development and the Ministry of the Environment will develop knowledge of the direct and spin-off effects of expanding commercial activities such as tourism and fishery-related enterprises. The knowledge acquired will be useful for the next update of the management plan... It will examine the spin-off effects on society and the business sector, and the topics for consideration will be decided in consultation with regional and local authorities.

The National Budget for 2012 (Prop. 1S (2011-2012)) granted NOK 30 million in the Ministry of Trade and Industry's budget for this knowledge-gathering project to be carried out.

Management Plan for the Barents Sea-Lofoten

The basis for integrated, ecosystem-based management of Norway's sea and coastal areas was provided by the white paper *Protecting the Riches of the Sea* (St. meld. nr. 12 (2001-2002)). The first integrated management plan was launched in 2006 and dealt with the Barents Sea-Lofoten area. An updated management plan for the Barents Sea-Lofoten was presented in March 2011 and debated in the Storting in June 2011.

The purpose of management plans for Norway's sea areas is to provide a framework for value creation through sustainable use of resources and ecosystem

services² in the sea areas, while maintaining the structure, functioning, productivity and natural diversity of the ecosystems. The management plans clarify the overall framework and encourage closer coordination and clear priorities for management of Norway's sea areas. They are also intended to increase predictability and facilitate coexistence between industries that are based on the use of these sea areas and their natural resources.

The Management Plan for the Barents Sea-Lofoten Area covers the sea areas from the baseline out into open sea and impacts resulting from human activities in these areas. However, a broader geographical area was chosen for the knowledge-gathering project, and all activities in the selected sectors in the three northernmost counties (Nordland, Troms and Finnmark) are included. The focus is on activities close to the coast, however.

1.1.1 Parallel knowledge-gathering projects

In connection with the updated management plan for the Barents Sea-Lofoten area the decision was taken to carry out another two knowledge-gathering projects in addition to the one presented in this report:

Knowledge-gathering project on the effects of petroleum activities

The Ministry of Petroleum and Energy (OED) carried out a knowledge-gathering project on the effects of petroleum activities in the unopened parts of Nordland IV, V, VI, VII and Troms II. The knowledge acquired will be useful for a possible consequence analysis for petroleum activities, and for the next update of the management plan. It examined the ripple effects on society and the business sector, including impacts on tourism and the fishing industry. The topics for consideration were

2. Ecosystem services can be defined as "the direct and indirect contributions of ecosystems to human well-being", see NOU 2013:10 *Natural benefits – on the values of ecosystem services*, for example. Many of the possible action areas for increased value creation and regional development in the Barents Sea-Lofoten area will lead to use of and/or impacts on ecosystem services. Fisheries, aquaculture, wind power, wave power, bioenergy from algae, seaweed and kelp, sea ranging and tourism are all examples of commercial activities based on the use of ecosystem services or other natural resources, and areas that can generate increased value creation and regional development.

decided in consultation with regional and local authorities, sectoral authorities and expert environments.

In total, 20 expert studies were carried out, with a number of expert environments exploring different aspects of petroleum activities in the northeastern Norwegian Sea. The work is summarised in the OED's integrated report *Kunnskapsinnhenting om virkninger av petroleumsvirksomhet i det nordøstlige Norskehavet*, which was presented in November 2012, see OED (2012).

Knowledge-gathering project for Barents Sea-Lofoten-Vesterålen area (KILO)

The revised national budget for 2011 (Prop. 120S (2010-2011)) granted the Institute of Marine Research funds to develop the knowledge base concerning marine ecosystems and resources in the Lofoten-Vesterålen area.

The emphasis was on increasing knowledge of spawning grounds, spawning stocks and sea floor habitats. The results from this knowledge-gathering project were presented in spring 2013 (Institute of Marine Research, 2013).

1.1.2 Focus on the High North

The High North is an important strategic area in Norwegian politics, and the Government's political platform (the Sundvollen Declaration) states that *"The Government will pursue an aggressive policy for the High North [which] shall promote industrial development, safeguard Norwegian interests and reinforce our cooperation with Russia and the Arctic states, as well as enhance the basis for activity and settlement in the North."*

The focus on the High North is also expressed in the white paper *The High North. Visions and Strategies* (Meld. St. 7 (2011-2012)). According to this white paper, the overall objective is to provide the framework for increased value creation in the High North in a way that takes account of the environment, climate and interests of indigenous peoples. Knowledge, activity and presence are key concepts in the focus on the High North. In concrete terms this means that it is Norway's ambition to

- be a leader in the field of knowledge about, for and in the north

- be top of the league in key areas of economic activity in the north and the best steward of the environment and resources in the north
- have a presence in all parts of Norwegian territory and in Norwegian sea areas in the north through policies to encourage settlement, value creation, nature management, employment and culture in north Norway

The knowledge-gathering project concerning increased value creation is not formally part of the focus on the High North. The problems considered in the project are nevertheless extremely relevant to the Government's ongoing work targeted at the High North. According to its political platform, the Government will *"prepare a coherent management and development plan for sustainable exploitation of natural resources in the High North"*, and the results from the knowledge-gathering project can make an important contribution to this work too.

1.2 Process

Knowledge Gathering – Value Creation in the North was overseen by an interministerial steering group consisting of representatives from the Ministry of Trade, Industry and Fisheries (chair), the Ministry of Climate and Environment, and the Ministry of Local Government and Modernisation. The work was carried out by a secretariat made up of two people. In addition, outside expertise was brought in to conduct studies and provide expert guidance. The specialist analysis reports that form part of the knowledge-gathering project were all produced at the request of the ministries involved, but by independent expert environments, which are responsible for their specialist content. The final report is based on this extensive analysis work and was written by the project secretariat on behalf of the steering group.

The knowledge-gathering project was divided into an input phase (March – June 2012) and an analysis phase (August 2012 – March 2014).

1.2.1 Local roots

The work was premised on the knowledge-gathering project being an open process with a high degree of consultation with local and regional authorities, and interest groups affected. At the start of the project, therefore, importance was attached to obtaining input from stakeholders through meetings with a large number of players/organisations, a stakeholder conference and written submissions, see below.

In order to root the work in Northern Norway, a regional policy contact group with representatives from the three counties affected and the Sami Parliament of Norway was set up in autumn 2012. This group held regular meetings with the steering group, as well as being involved in work on the individual studies in the form of comments and suggestions regarding terms of reference and draft reports. Its members also provided information for several of the studies.

Involvement and local roots were stressed in each study too, and were ensured by interviews and workshops/seminars with business players affected and other interested parties.

1.2.2 Input phase

A stakeholder conference with regional and local authorities, expert environments and interest groups affected was held at Lofoten Kulturhus in Svolvær in April 2012. The conference brought together 225 participants and the ministries received a number of submissions in the course of the day. During this phase the project secretariat also held meetings with various players on request.

All stakeholders were given the opportunity to make written submissions to the knowledge-gathering project. A total of 53 written submissions were received by the deadline in May 2012. The submissions can be accessed at www.nfd.dep.no.

All the submissions were assessed when the analysis programme was drawn up.

1.2.3 Analysis phase

The knowledge-gathering project covered a broad spectrum of industries and problems, and was aimed at visualising the potential for value creation in these industries separately and together. To ensure consistent handling, each sector was first analysed separately and then in connection with the others in the form of consistent pictures of the future. A number of cross-sectoral analyses of topics affecting all or several of the industries in question were carried out in parallel. An economic model was produced to describe the possible effects and ripple effects of prioritisations (policy instruments).

Sectoral analyses

The purpose of the sectoral analyses was to survey relevant business sectors and assess the potential for value creation in the medium term (2030) and long term (2050 and 2100). The following sectoral analyses were carried out:

- Fisheries, aquaculture and new marine industries, by Sintef, Institute of Marine Research and Norut (Winther et al., 2013)
- Tourism, by Menon and Nordland Research Institute (Enger et al., 2013a)
- Renewable energy, by Analyse & Strategi, Multi-consult and Kunnskapsparken Bodø (Analyse & Strategi et al., 2013)
- Mineral industry, by Vista Analyse and Sweco (Vista Analyse and Sweco, 2013)
- Other industry and business, by Menon (Espelien et al., 2013)

Key elements in the sectoral analyses included:

- Surveying the current structure of the sector, including players, competence level, cooperation, value chains with suppliers and customers, and degree of innovation.
- Quantifying the sector in terms of number of employees and value creation today, and an assessment of potential with current framework

conditions and given full implementation of policy instruments for the individual sector.

- Identification of challenges and bottlenecks, and proposals for to how to tackle them.
- Development trends that will be of great importance for development in the sector.

The industries looked at in the knowledge-gathering project were selected on the basis of the original commission, i.e. *tourism and fishery-related enterprises*, supplemented by two resource-based industries, renewable energy and minerals, which have aroused expectations with a view to increased growth.

The petroleum industry was not included in this project, as it is dealt with in the OED's knowledge-gathering project. The dialogue with the regional policy contact group made it apparent that there was also a need to survey other industry and business in addition to the four 'core industries'. A large number of industries, including oil and gas activities, make up other industry and business. For a complete list of the sub-industries covered by the general classifications see Appendix 5.

The public sector was not surveyed in the same way as the business sectors, as the focus was on business.

The public sector does, however, account for a substantial proportion of Northern Norway's economy in the form of employment and value creation. Angell et al. (2013) includes the public sector in its overview of employment, as does the economic model (NOREG). Business growth will affect the public sector, partly in the form of increased competition for labour and partly in the form of a probable increase in demand for public services.

In addition to the sectoral analyses, an analysis was done looking specifically at value creation in Sami industries, such as agriculture, reindeer husbandry, fishing, tourism and cultural industries (Angell et al. 2014).

Cross-sectoral analyses

The input phase pointed up some knowledge requirements that could best be assessed in the form of

cross-sectoral analyses, i.e analyses that do not really relate to a single business sector. The following cross-sectoral analyses were carried out:

- Ecosystem services, social assets and considerations, by Vista Analyse, Norut and University of Tromsø (Vista Analyse et al., 2013)
- Attractive local communities and labour market regions, by Norut Alta (Angell et al., 2013)
- Transport infrastructure in Northern Norway, status quo, development plans and importance for value creation, by University of Nordland/Bodø Graduate School of Business, Nordland Research Institute and Transportutvikling (Hanssen et al., 2013)
- Competence, research and innovation, by Damvad, Menon and SALT (Damvad et al., 2013)
- Cultural treasures and value creation, by Norwegian Institute for Cultural Heritage Research and Nordland Research Institute (Myrvoll et al., 2013)
- Policy instruments for boosting value creation, by Norwegian Institute for Urban and Regional Research (NIBR, 2014)

Some of these cross-sectoral topics are also discussed in the analysis of value creation in Sami industries and communities, see Angell et al. (2014).

Pictures of the future

A scenario process was carried out with a view to drawing qualitative pictures of the future for Northern Norway in 2030. These pictures of the future are partly based on the knowledge acquired in the sectoral and cross-sectoral analyses, but also to a large extent on the knowledge contributed by the players themselves. The players who took part in the process come from the industries in question, regional authorities, research institutions and interest groups in the region. The process was managed by Dietz Foresight and iPax, see Dietz and Solheim (2013).

Economic model

A model was produced for use in making projections of employment, industrial structure and the economy for various policy instruments. The model, known as NOREG, was created by Menon and Vista Analyse (Bruvoll et al.,

2014). It shows the impact on the regional economy of different policy instruments, but also takes account of limited resources, such as access to labour and capital. When the model was being developed, importance was attached to making it as general as possible, so that it could also be used for other regional economy analyses once the knowledge-gathering project was over.

1.3 Methodological approach

Various methodological approaches were used in the knowledge-gathering project. Importance was attached to interdisciplinarity, but with the main emphasis on a socioeconomic approach to the problems. There follows a brief presentation of some fundamental methodology choices:

- The various approaches used to assess future value creation and the interaction between different players for different policy instruments.
- The broad concept of value creation on which all the analyses were based.

1.3.1 Assessment of value creation

We used several different methods to obtain a picture of possible future value creation in the selected industries and in Northern Norway as a whole:

- Simple projection of the individual business sectors, with each analysis environment being free to choose its own method. Two forecasts were made for each sector, one of expected development with current framework conditions and one looking at what happens if the framework conditions are optimised for the individual sector. All these projections are partial, as they only look at the development in a single sector and do not take account of possible restrictions in terms of access to labour.
- Combined projection of different policy instruments, including packages of policy instruments, using a newly developed economic model, NOREG. The purpose of this model was to produce consistent calculations that, among other things, look at development in all the industries in question and also take account of limited resources in the economy.

- Qualitative assessment of individual policy instruments and packages of policy instruments based on experience from previous policy instrument use. These assessments are intended to supplement the quantitative calculations carried out in NOREG.
- Qualitative pictures of the future, see above.

None of these methods gives the final word on future value creation, and all have their strengths and weaknesses. But if the results obtained using these methods are considered in connection with each other, the overall picture can provide a better and more complete basis for assessing future development.

1.3.2 A broad concept of value creation

The broad concept of value creation is primarily connected with the use of culture/cultural heritage and nature/natural heritage in value creation and was launched in the white paper *Living with our Cultural*

BOX 1.1

Broad value creation for cultural and natural heritage

Broad value creation refers to mutually reinforcing interaction between cultural, social and economic value creation. Such reinforcing interaction is seen as contributing to sustainable development.

Economic value creation means increased profitability through the production and sale of goods and services, and increased employment for local communities as a result of innovation and brand/reputation building, for example.

Cultural value creation means increased knowledge and awareness of local cultural heritage, distinctive character, traditions, storytelling and symbols that provide a basis for communicating and developing local identity and pride.

Social value creation means the development of shared understanding, engagement, trust and a sense of belonging through cooperation, relationships, community projects, volunteering, solidarity and networking.

Environmental value creation means enhancing the qualities and values linked to cultural treasures, cultural landscapes and nature. Environmental value creation happens when these values are looked after, kept up and preserved, safeguarding cultural heritage and natural diversity. This is achieved by good, integrated planning and management of the physical environment, repair, adaptation, care, recycling and good resource management, for example.

Heritage (St. meld. nr. 16 (2004-2005)). The concept was developed further by two national programmes, *Value Creation Programme in the Cultural Heritage Sphere* and *Natural Heritage as a Value Creator*, see Box 1.1 for a definition of broad value creation linked to cultural and natural heritage.

A broad concept of value creation was also used in the knowledge-gathering project in terms of both the economic, social and environmental effects and the ripple effects of the sectors in question and the policy instruments used. The knowledge-gathering project did not focus on cultural value creation, but the subject is discussed in the analyses of cultural treasures and value creation (Myrvoll et al., 2013) and attractive local communities (Angell et al., 2013).

The broad concept of value creation was incorporated in the knowledge-gathering project in the following ways:

Economic value creation is the economic added value that the individual enterprise and industry as a whole contribute to society. Put simply, this is the enterprise's earnings (turnover) less the costs of buying goods and services in production. It shows payments to the main stakeholders: wages and salaries paid to employees, tax paid to local and central government, interest paid to creditors and return paid to owners.

Among other things, *social value creation* is about developing attractive local communities with varied jobs in terms of both competence and sector. Important factors covered by the knowledge-gathering project include who owns the enterprises, where they are based and who (how many) they employ, together with employee competence and nationality.

Environmental value creation is about the environmental impacts of the different industries and what can be done to reduce negative impacts. The emphasis is on greenhouse gas emissions in the individual industries, but other environmental impacts are also discussed. Planning linked to area use, including to avoid or reduce area disputes, was another important topic.

1.4 Reader guidance

The final report is based on a great deal of background material and is quite long itself. To assist the reader, there follows a brief description of what the various chapters contain.

Chapter 2 provides a brief historical account of business development in Northern Norway since the turn of the last century in order to put the knowledge-gathering project in its historical context.

Chapter 3 presents four qualitative pictures of the future produced in the scenario process described above. They put the knowledge-gathering project in its future context, with possible future developments being presented qualitatively.

Chapter 4 describes the resources (building blocks) that make up the conditions for both maintaining and further developing value creation in the relevant industries in the region. They include nature, people and capital. We look at current use of these resources and discuss future possibilities for increased harvesting of them.

Chapter 5 presents the status quo for the industries in question, including how much value creation and employment they contribute. It also describes competence profiles and R&D activity in the industries, as well as looking at their greenhouse gas emissions.

Chapter 6 takes a detailed look at the challenges that are faced by the business players and may prove an obstacle to realising the potential for increased value creation, and what policy instruments may help to deal with some of the challenges identified, with the emphasis on general policy instruments that could benefit several industries simultaneously. It also presents projections of value creation in Northern Norway using these policy instruments. These projections are based on the NOREG economic model.

Chapter 7 combines knowledge from the pictures of the future and model simulations to produce an overall assessment of the future potential for value creation in the north.

2

Integrated modernisation

By Peter Arbo

Photo: Ernst Furuhatt, www.nordnorge.com, Bodø

Movement characterised both the land and the people in the north. Movement impeded. Movement as opportunity. The landscape had tooth-like breakers and the treacherous whiteness of drifting snow. But also calm, blue silk roads for small boats and soft heather to cushion wandering feet. And the landscape could carry those who knew about its weather and winds, paths and navigable channels. Carry them far and wide. Across rolling waves and windswept plateaus, the people found traffic arteries in the north. Food and items of value changed hands. Friendships were established. Between people and cultures. Between mountains and coast. Between home and abroad. With a different heritage and culture, they all saw the same opportunities in the country to the north. A place where food could be harvested from fields of green and blue. A place with room for life and family. A place they could call home.

Kriss Rokkan Iversen

This knowledge-gathering project focuses on the opportunities for value creation in Northern Norway. It looks to the future. But in looking ahead, it is also important to look back. The past has left its traces. It shaped how we think and act, and it created our current framework conditions and starting point. Our historical legacy both offers opportunities and imposes restrictions. How the past is defined in itself affects our expectations regarding what can happen. Past and future are therefore linked materially, socially and mentally. In this chapter we want to fill in some history that will put the present knowledge-gathering project in perspective.

2.1 Northern Norway as a concept

Northern Norway was the first region to be given its own name (Niemi 1993, Tjelmeland 1996). Until the 16th century, Hålogaland was the usual designation for the northernmost areas with Norwegian settlement. Its borders were uncertain. During the Dano-Norwegian monarchy, which lasted from 1660 to 1814, Nordlandene and Finnmarken (or Vardøhus) were the two northernmost provinces. Frequent references were also made to Det Nordenfjeldske – the areas north of Dovre. From the late 19th century onwards, however, it became increasingly common to talk about Nord-Norge, or Northern Norway. The name itself was invented at a café table in Kristiania in 1884, the year in which parliamentary government was introduced in Norway. It originated in the Nordlændingernes Forening (Nordlander Association) (Aas 2012), a meeting place in what was then Kristiania for people who had moved to the capital from the north.

What was new about the term Northern Norway was that it brought together the areas from Bindal in the

south west to Grense Jakobselv in the north east. It was a mental construction that created a new region. On the one hand, the new name stressed that this far-flung area and the people who lived there made up a distinctive entity. In the words of poet Elias Blix: "Oh, I know of a land far away in the north". Artists like Peder Balke, Adelsteen Normann and Gunnar Berg had already made the midnight sun and fishing stations key icons. The old division into Nordlandene and Finnmark had also changed when Troms was separated off as a county in its own right in 1866. The umbrella term Northern Norway toned down the differences within the region, while drawing a clear distinction between the north and the rest of the country. On the other hand, the Norwegianness of the region was also stressed. To be sure, the region was something in its own right, but it was also part of the nation of Norway. In this way the name Northern Norway held a double message (Fulsås 1997): It expressed a distinction that it was important to have recognised. At the same time, it expressed a wish for equality and integration.

The period both before and after the dissolution of the union between Norway and Sweden in 1905 was one of nation building. The main emphasis was on national solidarity. In the north, this mobilisation was augmented by separate regional mobilisation, with the national awakening finding its echo in regional patriotism. The concept of Northern Norway spread from the exile community in Kristiania and increasingly gained a foothold inside and outside the region. It became a way of categorising reality that had consequences when it came to marking identity, establishing organisations and drafting government policy, resulting in the institutionalisation of the region (Paasi 1986, Tjelmeland 2000).

2.2 A modernisation programme

The concept of Northern Norway has always been associated with an underlying modernisation programme. When Northern Norway emerged as a separate region, the accepted belief was that all societies undergo linear development – from simple, primitive forms to more modern, advanced forms. Some areas and peoples would normally be more backward than others, in which case development could be accelerated with a push from outside. In this way, underdeveloped countries and regions could make a leap forward and become more like the most developed. The actual notion that history is progressing towards a goal was not new. The northern peripheries had long been the object of Christian missions, civilisation campaigns and state-building. What was new was a widespread belief in enlightenment and progress, which was now going to be converted into broad-based economic, social and cultural modernisation.

At the end of the 19th century the northern region was still dominated by a household economy (Fulsås 1996). The surplus from hunting and big seasonal fisheries was channelled into bartering, but people subsisted largely by exploiting versatile resources for their own consumption. The old system of trading monopolies, under which the merchants in Bergen and Trondheim enjoyed exclusive rights to all trade in the north, had come to an end, with trade and other enterprise gradually being decontrolled. New towns were established. The 1870s saw the start of a period of rich herring fisheries. A mining and quarrying industry, largely based on foreign capital and expertise, had also grown up in some places. Northern Norway nevertheless stood out as a backward area, stilling living in the shadow of history. "We lay hidden behind a hundred miles and the whole world. Even the land's children half-believed we existed, but did not know for certain," wrote Knut Hamsun in his poem "Nordland". By comparison with other parts of the country communications were poor, the mechanisation of agriculture had barely started, industrialisation was at a low level, and the educational system and public health service were not very well developed. The very concept of Northern

Norway therefore embodied a desire to bring the region into the new age.

2.3 The first modernisation project

The first active efforts at modernisation were driven forward by prominent traders and entrepreneurs in the north in alliance with government officials, frequently with a background in the region. Men like Ole Tobias Olsen, Elias Blix, Rikard Kaarbø, Christian Fredriksen and Hans A. Meyer were key campaigners. In the period leading up to World War I these and other pioneers were at the head of the crusade to establish new steamship companies and routes. The Nordland Line became an important issue. Mechanical workshops, herring oil factories, dairies, abattoirs, woollen mills and other industrial concerns were set up. Savings banks and insurance companies sprang up. The fishing fleet was rapidly mechanised as a result of pressure from the fishermen themselves. In many places there were local electrification initiatives. The idea of setting up the north's own university was launched as early as 1919. It was this period of optimism that Knut Hamsun depicted in the August trilogy and other novels. The industrial society was coming to Northern Norway.

The region was badly hit by the economic crisis of the interwar years. The fishing industry, which was extremely important in the north, experienced international sales problems and falling prices. The domestic markets were small, and the expansion of infrastructure had not come as far as in the south. The Pomor trade with Russian merchants also came to an end after the Russian Revolution. People had to rely on the traditional household economy to keep body and soul together. Towns stagnated and rural districts experienced strong population growth. Although trade conditions improved towards the end of the 1930s, the turning point came in the early years of the war. The German occupation boosted demand for goods and labour, resulting in a great deal of construction activity, the expansion of communications and the establishment of freezer and filleting plants in the region. The municipalities paid off their debts, as did farmers and fishermen, an important factor in the modernisation of these

industries after the war. But the war also brought great destruction, especially in Finnmark and Nord-Troms, and towns like Narvik and Bodø.

2.4 The second modernisation project

The second modernisation project had its origins in the mass movements that sprang up in the early 20th century, the national solidarity created during the war, and active government under the leadership of the Social Democrats in the years following World War II (Tjelmeland 1997). Although industrialisation came late to Northern Norway, the same was not true of political democracy. The introduction of universal suffrage and the economic boom in the run-up to World War I were reflected in an upsurge in union activities. More and more groups decided to organise. National organisations put out shoots in the north, setting up separate Northern Norwegian branches in many cases. Political radicalisation was also an early arrival in the northern region. In 1903, the first four Labour Party candidates to be elected to parliament were all from Northern Norway. The little people in the north turned against the remnants of the old fishery ownership system as much as big business and the new industrial magnates (Tjelmeland 1993, Drivenes and Jernsletten 1994). When the Labour Party came to power in 1935, it was the result of an alliance between workers, farmers and fisherman. In Northern Norway the boundaries between these groups were blurred, with many people earning their living in a number of occupations. The region became an important bastion for the Labour party, and in the interwar period Northern Norway provided a territorial frame of reference for demands for more aggressive government measures to reduce poverty and inequalities in living conditions.

The second modernisation project took shape after World War II. It began with the big reconstruction tasks and was followed up in 1951 with the Northern Norway Plan. This was a plan aimed at the broad development of trade and industry in the region through the injection of capital, development of power generation, road building and expansion of vocational schools. A separate development fund was set up for Northern Nor-

way. It was the ambition of the authorities to develop modern industry based on exploiting the region's natural resources. The Development Centre for Northern Norwegian Trade and Industry (Studieselskapet for Nord-Norsk Næringsliv), which brought together the economic and political elites in the region after 1947, had the same object in view. Industrial development and the transfer of labour from the primary industries to more productive industries were intended to result in higher export revenues, more permanent, stable employment and higher living standards. Since access to credit was rationed, the government was able to control investment to a large extent by means of state banks, tax rules and special appropriations in the national budget. Northern Norway now became a separate action area for government policy. The establishment of collective bargaining systems and legal protection for exclusive marketing rights in agriculture and fisheries were also of major importance in the development of the region.

Government policy contributed to rapid industrialisation in the north. Norsk Jernverk, Finotro and many other cornerstone enterprises were established. There was increasing occupational specialisation and structural rationalisation in both agriculture and fisheries. The Cold War also led to the large-scale expansion of military facilities in the north. The build-up of Soviet forces on the Kola Peninsula provided an additional reason for maintaining settlement and activities on the Norwegian side of the border. Regional policy initiatives were stepped up during the 1960s. The development fund for Northern Norway was replaced by the Regional Development Fund, and a number of new policy instruments were introduced, among other things with a view to dispersing centre-based industry to the rural districts. From the late 1960s onwards, expansion of the welfare state started to make its mark on the region to an increasing extent. The local government sector grew, and more women entered the labour market.

Although great economic progress was made in Northern Norway, the public focus on the region had several dubious features. The industrial connections

within the region remained weak. Modernisation was also based too much on imported technology and organised through group or centralised sales organisations. What is more, the subsidised investments also resulted in the development of overcapacity in many cases. Rationalisation in the primary industries, the expansion of education and new job opportunities in other industries also increased the number of people moving from the rural areas. A further effect of strong government intervention was to make political channels decisive for everything to do with business development. Political entrepreneurship could be more profitable than economic entrepreneurship (Eriksen 1996). The policy was also founded on the region being defined as an underdeveloped problem area. Northern Norway was a defective region that required help – in negative contrast to modern Norway.

A reaction to this modernisation project arose from the late 1960s onwards. Inspired by youth revolt, protests against the Vietnam War, the women's rights movement and new green values, there was extensive political and cultural mobilisation in the region. As a result Northern Norway was positively re-evaluated and became associated with wealth of resources and the good life in small village communities. It was not Northern Norway that was the problem, but the large-scale industrial visions of the authorities and the technocratic sectoral policy that had led to depopulation and centralisation. Strong political and cultural engagement created a new self-awareness in the region. It was at this stage that Northern Norway really became a shared identity marker on a mass scale (Tjelmeland 2000). Folk and pop groups started singing in Northern Norwegian dialects, and in the decade between the mid-1960s and mid-1970s a number of new joint bodies were set up, including the North Norwegian Cultural Council, the Harstad Festival, the North Norwegian Writers' Union and the Executive Committee for Northern Norway.

2.5 The third modernisation project

The third modernisation project is an unfinished and more open project that sprang out of the awakening produced by the postwar development model (Arbo

1996, 1997). New values emerged in the course of the 1970s and 80s. There was to be greater emphasis on promoting welfare, well-being, nature conservation and the environment in public policy. Preserving the pattern of settlement became a primary objective of rural and regional policy. At the same time, industrial growth came to a standstill. The proportion of industrial employees rose in Northern Norway up to 1981, but then de-industrialisation proceeded faster than in the rest of the country. The resource-based industries encountered both limits on resources and tougher international competition, and were now struggling with overcapacity. There were great expectations when the Northern Norwegian continental shelf was opened up for oil and gas exploration in 1979, but the oil miracle did not happen (Arbo 2010). Instead, the public sector became the most important development engine in the region.

In the 1980s, faith in the government's ability to control economic development declined. Deregulation and liberalisation became important flagship issues. We entered the age of materialism, with urban lifestyles and values being cultivated. There was also greater emphasis on change and innovation. Whereas rural development and government-directed industrial development had previously been used to create permanent, secure jobs, importance was now attached to entrepreneurship and innovation. Small and medium enterprises attracted greater interest at the expense of large-scale industry. In addition, knowledge, competence and technology dissemination were identified as key factors. The assumption was that more and more manufacturing would be moved to low-cost countries in the third world. The established industrial countries would therefore have to concentrate on knowledge-based industry and advanced services, which brought educational/research institutions and the role of towns as knowledge and communication centres more into the spotlight as well. In many ways, Silicon Valley became a symbol of what the industry of the future would look like.

In rural and regional policy this new paradigm led to local measures being encouraged. There was investment in entrepreneurship campaigns and entrepreneur

schools. At the same time the initiative was taken to set up new research foundations, competence centres and programmes aimed at supposed growth industries or strategic target groups, such as IT, aquaculture, private services and women. Both regional and industrial policy became more industry neutral and innovation oriented. From the 1990s onwards, it also became the basic assumption that economic growth must be home-grown. The authorities can try to provide a framework, but the development of dynamic business and knowledge environments must happen from the bottom up and through the interaction of different types of player. It was about developing so-called innovation systems, business clusters or new triple helices. This remains the prevailing approach internationally.

Northern Norway was not a separate action area in the third modernisation project (Arbo 1999). However, the project has gradually become internalised in the ways all parts of the country think and work. All European regions are now expected to develop their own strategies based on their specific advantages and possibilities. Some elements are familiar, such as identifying value creation potential and growth areas. Other elements are new, such as promoting continuous innovation, developing partnership and enhancing attractiveness. Whereas the second modernisation project was imbued with an ideal of equality and justice, with the aim being to raise Northern Norway to national level, the emphasis is now on cultivating difference and flexibility. In addition to the central policy instrument apparatus, which currently consists of Innovation Norway, SIVA – The Industrial Development Corporation of Norway and the Research Council of Norway, the third modernisation project has produced a number of new players, all with responsibility for business development: counties, universities, colleges, research and knowledge parks, incubators, seedcorn and venture capital companies, small business centres, etc.

Northern Norway has undergone great changes in recent decades. The region has become more like the rest of the country in many ways. At the same time, the internal differences within the region have become

more apparent. The decline in agriculture, fisheries, fish processing and other traditional industries has been felt in many places. Prolonged emigration and declining birth figures have left their mark. Other places have enjoyed good growth in fish farming, exploitation of new species, oil and gas, tourism and culture, new knowledge-intensive services, and different types of public enterprise. This makes it more difficult to place Northern Norway on a simple centre-periphery axis, although the region is still characterised by relatively one-sided industry and fragile business environments. Nor is the centre-periphery dimension prominent in the current modernisation project. The perspective is global. All countries and regions are engaged in global competition. Modernisation is no longer perceived as measured development towards clear pictures of the future. Instead, it is dominated by uncertainty and risk. New and smarter products and solutions constantly have to be developed in order to keep the competition at bay. The only constant is change. At the same time, human destruction of the natural environment has become a more pressing reality. Business development is therefore also increasingly about climate change, biological diversity and the protection of ecosystems, something that will require more integrated, ecosystem-based forms of management.

2.6 From Northern Norway to the High North

Northern Norway remains an important category and reference, but since the 1970s there have been a number of changes in how the borders are drawn and reality is organised. Other territorial entities have become more relevant (Niemi 1996, Arbo 2007). When the new counties were created in the mid-1970s, the county borders began to acquire increasing importance. Responsibility for rural and regional policy instruments has gradually been delegated to the counties, with political, administrative and financial resources being concentrated on their own development. The Executive Council for Northern Norway was first expanded to include Namdalen, followed by the whole of Nord-Trøndelag, before finally being wound up as part of the increasing 'countyfication' (Røvik 2011)

of Northern Norway. Border region cooperation was expanded in parallel with this, starting with cooperation in the Cap of the North. This was followed by various INTERREG programmes, the Barents Cooperation and the Barents Region in 1993, and the Arctic Council, which now has a permanent secretariat in Tromsø.

The Sami mobilisation that followed in the wake of regional mobilisation was another important factor. The Sami Parliament of Norway was set up after the controversy surrounding development of the Alta-Kautokeino river, with close contacts being established with the Sami institutions in neighbouring countries. The Sami Development Fund has its own support area, while the creation of the Action Zone defined Finnmark and Nord-Troms as a separate region. Nor has there been any consistent territorial logic to government restructurings and reorganisations. Each sector has chosen its own geographical demarcation. In the petroleum industry, for example, the region is divided into the Norwegian Sea and the Barents Sea, which for administrative purposes extends as far down as Lofoten. It might also be argued that Northern Norway has never had an undisputed regional capital. Rather, the situation has been characterised by rivalry between towns, especially Tromsø and Bodø. Everywhere pursuing its own reputation, brand and image building has also been a recurring theme in recent years. All in all, this has resulted in ever fewer activities and projects addressing Northern Norway or having the region as their key frame of reference.

Today, High North policy represents the clearest articulation of the third modernisation project in the

north. High North policy has a broader geographical impact area than Northern Norway. Attention has been turned to the large sea areas in the north, to Svalbard and the Arctic. These are areas where there is expected to be increased petroleum activity, other resource harvesting and shipping in years to come. Climate change is making the Arctic areas more accessible, but also reinforcing the need for management that takes account of vulnerable nature and the consequences of expanded industrial activity. Attention is also focused on Russia and the open borders created after the end of the Cold War. High North policy underlines the need for the assertion of sovereignty and international recognition for the exercising of Norwegian authority, as well as striving for neighbourliness, peace and stability in the Near Arctic areas. In other words, High North policy is about the future, the resource potential and the boundless possibilities in the north – provided that the risk factors are handled sensibly. It is not about the 'problem child' in the north, the backward region in need of help.

Northern Norway has not been forgotten, however. The requirement that increased industrial activity should also benefit the region is clearly expressed in High North policy. Modernisation therefore remains the order of the day in Northern Norway. But the question now being asked more openly is which future to invest in. *Knowledge Gathering – Value Creation in the North* takes an in-depth look at some of the different future opportunities that may open up for Northern Norway based on the current situation, and examines the extent to which choices made today may influence what that future will be like.



3

Looking into the future: Northern Norway in 2030

Photo: Terje Rakke/Nordic Life, Visitnorway.com, Sorrisniva

And the north country had more to offer for knowledgeable people with a nose for innovation and value creation. As time and technology moved on. Fish, seaweed and sea urchins could be harvested and turned into valuable exports for the big, wide world. Bodies of water rich in nutritive salts and accessible areas provided a basis for marine crops in fish cages. The sea's plants and animals were researched down to the smallest detail and valuable substances produced in test tubes. Below the seabed, traces of ancient plants and animals waited to be extracted, and turned into energy and assets. The water above offered power for those who knew how to harvest the waves and tides. Hidden rocks saw the light of day, and the wind travelled far through turbines and along cables. People from all over the world headed north to experience the majestic scenery – and to test their own limits against mountain and ocean.

Kriss Rokkan Iversen

A picture of the future is not a prediction or forecast of the future, but aims to say something about possible future development given important driving forces, that is to say factors or forces that influence society over time.

By developing pictures of the future it is possible to chart and analyse external forces of change, so-called driving forces that may influence future development. These driving forces can be categorised as certain or uncertain. Certain driving forces will in all probability continue in the same direction, whereas uncertain driving forces may change course. This method can increase our understanding of what can happen if the most important driving forces continue in the same direction or change course. The aim is to increase understanding of surrounding factors and provide greater insight into the connections between external influencing trends and our own scope for action. This can provide leeway for new thinking and path choices, and open up the possibility of changing locked-in patterns.

Nor is a picture of the future a description of development that is specifically wished for. Pictures of the future are used to visualise tendencies and the probable consequences of different choices and trends. Scenario projects generally aim to increase understanding of the surrounding world, open the way for new thinking and provide a backcloth against which to elaborate strategies. The process itself is an important part of drawing pictures of the future, perhaps the most important. The participants meet on 'neutral ground', where they are free to discuss what the most important driving forces for development are, which driving forces we can do something with, how we should choose and what we should do.

Pictures of the future must be relevant, consistent, realistic, of importance and clear. They must not simply identify relevant development trends, but also describe them, and assess their significance and implications. They must be based on systematic, well-founded assessments of what might happen. It is important to remember that pictures of the future are fundamentally uncertain and must not be taken as a fact about development. Having said that, they can be instructive and give us an insight into possible futures all the same.

The work on the pictures of the future and results are described in brief below. The report is based on Dietz and Solheim (2013), which we also refer readers to for a more complete description of the pictures of the future.

3.1 Creating the pictures of the future

The pictures of the future were created through a participant-based process in which a broad-based group of largely Northern Norwegian players took part. This group was put together with a view to ensuring a good spread in terms of both expertise and geography.

The scenario process employed classic scenario methodology in the tradition of Shell, Global Business Network (GBN) and Stanford Research Institute (SRI). The most important part of this process consisted of three work meetings.

- At the first meeting the group discussed external drivers of change that will affect future business development in the north. Certain and uncertain driving forces of interest were systematised.

- At the second meeting work was started on the basic structure of the pictures of the future. Key uncertain driving forces were defined and processed. The core idea in the individual pictures of the future and the main dimensions (themes) that recur in all the pictures were discussed.
- At the third meeting the pictures of the future were provided with content in the form of sketches.

In addition to these meetings, we also held preparatory meetings with key players, a work meeting with the sectoral analysis providers, a work meeting for representatives of the three counties and the Sami Parliament of Norway (both political and administrative), and a writing workshop at which the sketches from the third workshop were worked up.

3.2 Driving forces

Pictures of the future consist of both certain and uncertain driving forces. The certain driving forces are found in all pictures of the future, whether seen or unseen. It is the uncertain driving forces that define the differences between the pictures of the future.

Certain driving forces

Certain driving forces can be heavy, established trends that are easy to identify and will make themselves felt in our chosen time frame (2030) no matter what. They can also include events and changes that have already happened, but not yet manifested themselves clearly. Certain driving forces are often connected, in which case it is important to identify what is cause and what effect.

Certain driving forces are relevant to future business opportunities in the north. They provide the framework for development and will apply whatever the future. They form part of all four pictures of the future, whether explicitly or implicitly. The certain driving forces identified in the scenario process were as follows:

- A growing global population and larger middle class.

- An increased need (and demand) for food, water, renewable and non-renewable energy, phosphate, minerals and leisure experiences.
- A continuing trend towards centralisation in Norway, with towns in the south attracting people.
- A continuing global trend towards centralisation.
- Global warming that produces real climate change in the north and the rest of the world.
- An ageing population in Northern Norway.
- A new power structure in world politics and the world economy, with the BRICS countries and Asia become more powerful, while the West loses influence.
- Continuing rapid technological development, e.g. in the form of new materials.
- ICT continues to characterise industrial and social development.

Key uncertain driving forces

A driving force that is key when it comes to generating pictures of the future is characterised by being both extremely uncertain and extremely important. The following driving forces were judged to be the most important during the scenario process:

- *Global climate policy*: Will there be willingness to introduce international/supranational climate policy regulations? In this case it is possible to envisage either agreement being reached on reducing greenhouse gas emissions globally or the present situation, with few binding agreements, persisting.
- *Petroleum activity in the north*: How extensive will petroleum activity in the north be? This question relates to the size of the finds that will actually be made, development in oil and gas prices that affects profitability, and the extent to which the finds give rise to industrial activity on land in Northern Norway.
- *Attitude to competence*: How will the attitude to knowledge and innovation develop in Northern Norway? Will development be characterised by openness and curiosity or scepticism to change?

These three driving force capture uncertainty at three levels: globally, nationally and regionally.

The three uncertain driving forces provide the basic structure for the pictures of the future. Normally two key uncertain driving forces are used and combined on two axes at right angles. In this case the scenario group came up with three driving forces, which gives eight possible combinations. Four of the possible combinations were judged to be most interesting and realistic, and they therefore provide the starting point for the four pictures of the future:

- *Climate innovation*: strict climate regulations, low petroleum activity and greater innovation willingness
- *Gas rules*: strict climate regulations, high petroleum activity and poor innovation willingness
- *Taking matters into our own hands*: few climate regulations, low petroleum activity and greater innovation willingness
- *Class society in the north*: few climate regulations, high petroleum activity and greater innovation willingness

Some of the pictures of the future are based on quite radical changes in national framework conditions that affect industry's scope for action in the north. This is partly reflected in the uncertain driving forces chosen, with both petroleum activity and the attitude to competence being affected by national framework conditions. But a number of other framework conditions have also changed, such as how active an industrial policy is pursued and the extent to which Northern Norway will be prioritised in national policy. The framework conditions could therefore have been handled as a separate driving force, but such a solution would also have made it impossible for the pictures of the future to form the basis for strategic thinking to do with political framework conditions.

3.3 Climate innovation

In 2030 Northern Norway has become an important supplier of new knowledge and innovative products and services in renewable energy, seafood, new marine industries and surveillance of the northern sea areas.

Europe has had its eyes opened to the resources of Northern Norway. The turnaround in climate policy has changed the rules of the game in the world economy, and the winners are those who think blue and green.

There is global agreement on fighting climate change, and fossil energy is seen increasingly as unacceptable – the world's energy needs will have to be met in new ways. In order to make up for lower petroleum activity, major prioritisation of R&D is launched with industry in the driving seat. In Northern Norway this prioritisation includes marine industries, bioprospecting, climate solutions, renewable energy and Arctic technology. It offers attractive opportunities for researchers and specialists, but the eye of the needle is narrow for northerners without higher education.

There are tight restrictions on petrol- and diesel-driven transport, which makes long-distance travel to and from Northern Norway difficult. At the same time, it provides a basis for innovative solutions, with the development of gas-powered ships that can cope with Arctic conditions and meet international environmental and safety standards, increased processing of raw materials to reduce transport requirements, and new methods for keeping fish fresh for longer. The regulations hit tourism and the experience industries in Northern Norway, and many hobby and 'part-time' businesses disappear. Niche offerings in ecotourism, aimed at affluent foreign tourists, do well, however.

The renewable energy industry is growing strongly, partly financed by capital that previously went into petroleum activity in the North Sea. There is considerable expansion of renewable energy in Northern Norway, combined with transmission lines between Northern Norway, Finland and Sweden, and on to the European power markets. Owing to much higher energy prices, it is more profitable to export renewable energy than to use it in local industry. The prioritisation of renewables is area-intensive and does not create many jobs in the immediate environment, which is a source of local conflict.

3.4 Gas rules

In 2030 Northern Norway is experiencing a gas boom, which everyone knows will not last, but is nevertheless changing society. Competence in renewables has disappeared, fisheries and aquaculture are competitive, but ownership and profits end up in the south. World-class R&D environments do not manage to establish close collaboration with local industry, however. Public money is used to maintain welfare and settlement structure for as long as possible.

A global climate treaty, with agreement on a high CO₂ price, is implemented in the early 2020s. Natural gas is an important transitional solution, giving rise to a gas boom in the north. A large proportion of exports go to China, and the Chinese invest heavily in the north. As this is regarded as a transitional industry, companies are cautious about investing in local facilities and competence. Chinese construction workers are responsible for much of the building, and the facilities are managed from Stavanger and Beijing. A small number of local jobs are created in operation and maintenance, but employment turns out to be lower than expected.

The high CO₂ price puts up fuel prices, forcing the fishing fleet to go over to efficient, gas-powered vessels. In Northern Norway there is not much capital available for implementing such a change, so ownership of much of the fishing fleet moves south.

There are fewer long-haul tourists, with many people choosing virtual travel experiences, in which holidays can be delivered electronically at home.

Northern Norway's minerals are still in the ground as a result of area disputes, lack of entrepreneurial spirit and widespread popular scepticism about an industry that can disturb and destroy nature. The renewables sector is hit by the prioritisation of natural gas and investment virtually stagnates.

Unemployment takes a firm hold in peripheral areas. Centralisation has accelerated and young people are turning their backs on the peripheral municipalities.

The gas boom has produced some additional tax revenue, and the municipalities spend it on measures aimed at improving welfare and counteracting unemployment.

3.5 Taking matters into our own hands

In 2030 Norway and Northern Norway have experienced radical change in their industry. After some years of crisis and floundering, there is groundbreaking innovation in seafood and tourism. The marine and experience industries are more knowledge-based than in 2013. Northern Norway becomes Europe's new blue food bowl and a breathing space in a cramped world plagued by climate change.

Uncertain future prospects globally are leading to increased self-sufficiency and exploration of more energy sources, such as unconventional fossil energy and renewable energy. The price of oil and gas plunges after 2014. Lack of profitability means that several interesting finds in Norwegian waters are abandoned. Oil and gas production plays a smaller role in Northern Norwegian industry.

Global demand for minerals and rare earths increases. Several mining projects get under way in Northern Norway despite being controversial. Sami organisations and nature conservationists mobilise in the "Save our mountains and seas!" campaign.

The tourism industry and marine industries set up a joint marketing office in 2018, attracting both investors and capital. Clean food, clean nature, a clean environmental conscience and dark humour are marketed. Growing global demand for healthy, nutritious food and unspoiled nature is exploited in Northern Norway, and the region offers a break from life in polluted cities. Plane tickets are cheap, and for Europeans and Asians on ordinary pay Northern Norway is just a flight away.

Fisheries are hit by crisis around 2016, with a sharp decline in important stocks. The industrial base for a number of small communities along the coast crumbles, while coastal fishers who cooperate with the tourism

industry do better. Among other things, they offer exotic fishing trips for lumpfish and other species. The aquaculture sector experiences strong growth, however.

Government research grants are made available for aquaculture and biotechnology pilot projects. Tourism research also receives a boost, with R&D projects in market and brand building, including special prioritisations to promote Sami tourism.

Northern Norway has a large surplus of hydropower owing to higher rainfall, resulting in low electricity prices, which are exploited by power-intensive process industry in Helgeland. Demand for renewable energy declines for the same reason, and the prioritisation of renewables in the north grinds to a halt.

There is increased immigration of foreign specialists, who take jobs in aquaculture, the bioeconomy or experience industries for shorter or longer periods.

3.6 Class society in the north

In 2030 oil-driven growth has created new class divisions in Northern Norway. Bodø, Tromsø and Alta make most of the decisions and the peripheries are virtually empty of people. Oil activity is in top gear and the sea is being exploited in more and more ways. On the other hand, large areas of land have been made nature reserves, which reindeer owners are benefiting from. The winners are highly educated specialists in biotechnology and engineers working in petroleum and oil spill preparedness.

In 2018 the way is opened for exploration in vulnerable sea areas and promising finds are soon identified. Petroleum activity becomes an engine for industry in the north. Most of the activity is managed from the region's cities, with a few oil bases and terminals strategically located along the coast. Bodø and Tromsø are popular towns for entrepreneurs in pharmaceuticals, marine biology, aquaculture and satellite technology. Talented engineers make a beeline for Tromsø and Hammerfest, and the educational level in Northern Norway is higher than the national average. The money and talent go to petroleum, biotechnology

and aquaculture. Northern Norway becomes a centre in international biotechnology, with strong growth in highly paid biotechnology jobs.

The prosperity in the north is also due to a strong public sector with good welfare schemes. This welfare provision makes the region more attractive for Norwegians and immigrants alike, and Northern Norway takes in many climate refugees, for example.

The extraction of petroleum reserves in vulnerable areas boosts interest in nature conservation. Large areas in Northern Norway are turned into nature reserves.

The interior, with the exception of the Sami core areas, is virtually unpopulated. Small communities of people who have consciously withdrawn from modern urban life can be found here and there. The Sami population is granted greater self-government, and the conditions for reindeer husbandry are better than for a long time.

Tourists come to experience Northern Norway's nature and 'yesterday's world' in the abandoned villages. The tourism industry, which specialises in hunting trips and nostalgia-based experiences, is an important employer on the peripheries.

The gap between the people working in the exciting new industries and those dependent on public assistance gradually increases in the 2020s. People talk of a growing three-way split between oil, biotechnology and the rest of industry.

3.7 What happens after 2030?

The pictures of the future stop in 2030 and speculating about what happens after that is a demanding task, as the longer the time frame, the greater the uncertainty and complexity. It is nevertheless interesting to discuss what *could* happen after 2030. Several of the uncertain driving forces will continue to make themselves felt in subsequent years, and the certain driving forces may become uncertain after 2030. In the longer term it is also interesting to discuss the possibility of fundamentally new development factors and what they might mean.

Global climate policy

In *Climate innovation* and *Gas rules* it is assumed that there will be a binding agreement on greenhouse gas emissions at a global level. These regulations could promote technological development that would change the global energy picture radically. This development could undermine forms of energy where Northern Norway has – or is expected to have – natural advantages, or conversely give Northern Norway brand new opportunities. In the long term new technology could make carbon capture possible on a large scale and render the question of CO₂ less relevant.

In *Taking matters into our own hands* and *Class society in the north* there is no global agreement on measures to reduce greenhouse gas emissions. This could lead to a race for remaining fossil resources and/or even more dramatic climate change, causing large refugee movements. This could, however, create pressure for more effective regulation at international or supranational level, with cooperation across former dividing lines. If the crisis becomes serious enough, regulations might be imposed by authoritarian means.

Petroleum activity in the north

In *Class society in the north*, there is willingness to exploit new oil and gas finds, with strong competence environments being developed in the region. In this picture of the future the sea off Northern Norway could become Norway's big new petroleum province as the importance of the North Sea declines. Northern Norway could develop a supplier industry with special competence in Arctic conditions. In the very long term the importance of the industry will decline, as the non-renewable resources will run out sooner or later. But as this would happen over a long period, it would be possible to adapt to the change without the costs being too high.

In *Gas rules* petroleum activity in Northern Norway grows strongly up to 2030, but is assumed to decline more or less suddenly after that. This means that society and industry in Northern Norway could experience adjustment problems in the period after

2030. At the same time, no large petroleum operations were established in Northern Norway in this picture of the future, something that, in isolation, might help to reduce the adjustment problems.

In *Climate innovation* and *Taking matters into our own hands* petroleum activity in the north is relatively limited. In both pictures of the future it is plausible that petroleum resources are found in the sea areas in question, but not exploited for environmental reasons or because they are not profitable. Given that there are unexploited petroleum resources, one of two things could happen: the resources increase in value and could be extracted at a later date, or the resources decline in value because it is no longer profitable or acceptable to extract them. Conserving the resources keeps open the possibility of both covering traditional energy needs and exploiting the petroleum resources for something other than energy.

Attitude to competence

In *Gas rules* society is characterised by a laid-back attitude to and weak interest in competence, while the public sector remains well funded. Such a situation would provide little stimulus for exploring new forms of value creation. Change would largely come about as a result of outside pressure. With this as its starting point, Northern Norway could once more find itself in the role of being very much a supplier of raw materials, with little value creation locally. Northern Norway could end up being a 'museum' of traditional industries.

In the other pictures of the future innovation willingness is strong, and new generations acquire competence that is versatile and industry-relevant. This provides fertile soil both for growth and innovation in old industries, and for exploiting new business opportunities. It would then be possible to boost processing and exports of more end products based on new technology and new methods, for example. In a more innovation-friendly world like this, the university and institute sector could actively and consciously seek cooperation with industry through increased regional partnership and coordination.

Some possible fundamental trend breaks

What could turn development round and possibly stop driving forces assumed to be certain after 2030?

- *World population growth is stopped:* As the result of a new global epidemic, for example. Diseases that cannot be controlled can hit the young and elderly especially hard.
- *Less need for natural resources:* With lower population growth, there will be much less need for food and other resources than assumed in the pictures of the future. War and unrest could also disrupt or weaken demand for the resources that Northern Norway has to offer.
- *Centralisation ceases:* If, for example, the EU is expanded to include Russia and Turkey, Northern Norway could experience extensive immigration. The premise is that young Russians, and possibly the unemployed from other countries, would be willing to take relatively poorly paid jobs in rural areas.
- *A weaker China:* A possible situation akin to civil war in China could spread and trigger large-scale conflict in Asia. The consequences might be economic stagnation or crisis in the world economy, followed by a substantial fall in Chinese and Asian demand for the goods that Northern Norway has to offer.
- *Prolonged global economic recession:* Is it certain that the current financial crisis will soon be over? The financial crisis could take a firm hold or be replaced by new crises, which could lead to a prolonged global recession. One of the consequences would be increased protectionism, making access to export markets difficult for businesses in Northern Norway.
- *Technology does not deliver (or springs a surprise):* Is it conceivable that technology either will not provide the answer to fundamental challenges or even create complications? A possible example would be a more efficient technology that accelerates exploitation of non-renewable resources, offsetting the effect of carbon capture.

4

Building blocks for value creation and business development

Photo: Per Ivar Somby, Tromsø Library

There it lies. The colourful tapestry of the north. Spread between sharp peaks and salt-encrusted skerries, draped over seaside heather, reindeer lichen and willow herb. Woven by people who made the land their own down the ages. Over mighty warps of sea, mountains, forests and plateaus. With durability in weave and pattern. Durability from mastery and experience. Durability drawn from the encounter between people and landscape in the north. Weft threads from point to point of life and values. Twining threads between different times, between different communities, between different people. Shades of blue from gazing out to sea. Shades of green from gazing to the high plateau. And golden wefts of experience-based knowledge and innovative strength. Which together form a north-facing pattern – where entrepreneurship and value creation can be seen extending from when it all began to the end of the horizon.

Kriss Rokkan Iversen

What are the most important building blocks for value creation and business development in Northern Norway? What are the input factors that are needed to increase the value of our fish and attract tourists with money to spend? What role do nature and the services it gives us play for our industries and quality of life. The knowledge-gathering project is based on the assumption that value creation must be sustainable. This means taking account of the economic, social, cultural and environmental aspects of value creation, and balancing these considerations in a way that secures the objectives of economic growth, social development and care for the environment. Sustainable growth must provide greater welfare and improved quality of life, while looking after and improving our basis for life in the long term.

In order to take an in-depth look at the basis for sustainable development, *the knowledge-gathering project* identifies five fundamental factors that provide a framework for and contribute to value creation in different ways. Those factors are natural resources and ecosystem services, labour, competence and research, infrastructure, and capital.

4.1 Natural resources, the environment and ecosystem services

Natural resources are accessible sources of raw materials or energy in nature that can be converted into goods or services that satisfy human needs.¹ These resources are key input factors in economic

¹ The discussion of natural resources is based on the sectoral analyses of four industrial sectors: *marine industries, tourism, renewable energy and the mineral industry*. Natural resources are not discussed for the sectoral analysis of other industry and business, as the sector is heterogeneous and makes less use of natural resources than the other sectors focused on.

value creation. Northern Norway has a wealth of natural resources, something that is quite apparent from the industrial sectors looked at in the knowledge-gathering project: marine resources, tourism, renewable energy resources and mineral resources. This chapter describes the natural resources required by these industries in order to create economic assets.

Commercial activity impacts on the external environment by exploiting nature's bounty and harvesting natural resources. If insufficient account is taken of the environmental challenges this entails, the industries may impair or weaken the basis for their own activities in the longer term. This analysis of the industries' resource base therefore also looks at the environmental challenges linked to the exploitation of resources.

In order to investigate the extent to which sustainable industrial activity is dependent on nature and the region's ecosystems being in good health, the knowledge-gathering project also took a closer look at ecosystem services in Northern Norway. These are benefits from ecosystems that are of use to us, not just as input factors in economic value creation, but in the form of social, cultural and environmental assets that are far harder to quantify. Ecosystem services are of fundamental importance to people's basis for life and value creation.

4.1.1 Ecosystem services

The ecosystem service approach is a framework for analysing, visualising and communicating society's and people's dependence on ecosystems. It has its origin in the recognition that people are dependent on natural diversity, nature and the services provided

by nature, and that well-being, basis for life and quality of life rely on ecosystems being kept in good health. The discussion of ecosystem services is based on the report *Økosystemtjenester i Barentshavet – Lofoten* (Vista Analyse et al., 2013).

Marine industries, tourism, renewable energy and the mineral industry are all examples of both commercial activities that are based on or affect ecosystem services, and sectors that can provide increased value creation and regional development in Northern Norway. Some of the services provide a more or less direct basis for traditional value creation in what are important industries for Northern Norway, such as fisheries, aquaculture and tourism. These ecosystems are the easiest to put an economic value on and can be regarded as input factors in production on a par with labour and capital. Other industries, such as the petroleum sector, offshore wind power, shipping and mineral extraction do not use ecosystem services directly, as they are not based on living biological resources, but the activities of these industries can *impact on* ecosystems and their ability to produce ecosystem services.

It is usual to differentiate between four different types of ecosystem service, all of which are found in Northern Norway²:

1. *Supporting ecosystem services* are fundamental to virtually all the other services provided by ecosystems, so taking care of them is crucial to the sustainability of the entire ecosystem. Supporting services underpin the nutrient, water and carbon cycles, and the value of habitats for different species. Supporting ecosystem services as a whole constitute the actual basis for the various goods and services that are of direct use to us humans.
2. *Provisioning ecosystem services* represent the most familiar and visible goods and services harvested by humankind, and include food, raw materials, fresh water and medicinal resources. It is reasonably simple to place an economic value on such

ecosystem services. The rich fishery resources in the sea off Northern Norway are a good example of such services.

3. *Regulating ecosystem services* are the services that ecosystems provide by regulating the quality of air, soil and water, and protecting against flood and disease, for example. Among other things, the ocean has a great capacity for sequestering the greenhouse gas CO₂ and purifying a good deal of human waste, which can save people the cost of building purification plants. Such services have their limit, however, and exceeding an ecosystem's renovation capacity can have very negative consequences.
4. *Cultural ecosystem services* represent the non-material benefits that people obtain from ecosystems, including through nature experiences, contact with nature and outdoor life as a source of spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences. Tourism and recreation require a clean coast that can be travelled to and used, and Northern Norway has a wealth of such interests and opportunities. Cultural ecosystem services also represent the aesthetic value of nature – of the sea and landscape as a basis for culture, art and design.

Use of an ecosystem service by an industry or person can be at the expense of others being able to use the same service, so careful consideration must be given to the sort of use that should be permitted. Large-scale expansion of wind power along the coast could, for example, reduce the potential for using nature as a basis for prioritising tourism, while aquaculture could have an adverse effect on fisheries and/or bioenergy production. Such considerations are a fundamental challenge in the management of ecosystems and ecosystem services, and therefore provide a framework for prioritisation of increased value creation in Northern Norway.

Looking at human use of ecosystem services from an industrial perspective gives rise to some important questions: How can the services be used without destroying their function? Is there a conflict between the interests of different industries or other user

² This overview is based partly on Vista Analyse et al. (2013) and partly on NOU 2013:10, *Natural benefits – on the values of ecosystem services*.

groups in using the ecosystem services? Between the larger community and local community? Between generations? Between different geographical locations? If there is a conflict and considerations therefore have to be made, how can this be done in the best possible way?

There is no simple, right answer regarding what ought to be considered in different situations. One of the major challenges is how to measure the benefit of different services, and what and who should be included in the considerations. The study of ecosystem services also seeks to expand the concept of benefit from simply looking at nature as a product input in economic production to also considering the importance of nature and ecosystem services in terms of basis for life and quality of life. In many contexts, especially in assessments of exploitation of and impact on ecosystem services and natural resources perhaps, it would be extremely difficult to put a monetary value on all the effects.

In order to provide the best possible decision-making basis for this type of assessment, it is important to visualise the consequences of humankind's use of ecosystem services in the form of either calculated costs or unpriced effects. Vista Analyse et al. (2013) employs methods used in socioeconomic analysis to systematise the positive and negative effects of different measures with a view to achieving a broader decision-making basis. It also tries to put a price on effects as far as possible. With such considerations, it is important to identify all the effects, as in socioeconomic analysis, in order to establish whether there are real conflicts of interest, or whether there are fewer and/or smaller conflicts of interest than first appears.

The theoretical discussion of these problems is explored through four example studies in which Vista Analyse et al. (2013) looked at the possible establishment of an offshore wind farm and/or large airport in the Municipality of Vågan, mining in the Municipality of Kvalsund with the emphasis on dumping at sea or on land, macroalgae used for bioenergy and biorefining, and the relationship between coral reef protection

and trawling. The different examples put several of the more theoretical considerations into concrete terms.

Some considerations may turn out to be specious, as in the case of the report's example study looking at coral reef protection and fishing. It turns out that protecting corals from bottom trawling would probably have positive consequences for fishing too, because the coral reefs can lead to more fish in the long term. This means that there is no need to choose between one use and the other.

In order to visualise considerations between interests and geographical areas, the distributive effects for both priced and unpriced impacts need to be analysed and identified. This is no easy task, however. In the example study concerning possible mining in the Municipality of Kvalsund it is a challenge to obtain an overview of all the impacts, while a large number of impacts are impossible to price. In this instance a polluting industry that can generate increased value creation and local jobs is lined up against negative impacts on the environment and other industries, such as fishing and reindeer husbandry. In this example study it is possible to offset the revenue from mining against the negative consequences for ecosystem services, and to clarify which stakeholders and geographical areas would benefit or suffer. The analyses of the consequences and socioeconomic impact of different measures are intended to provide a good decision-making basis, but ultimately it will be up to the political authorities to decide which consideration to prioritise.

4.1.2 Natural resources and environmental challenges

We will now take a look at the existence and exploitation of natural resources in Northern Norway in relation to fisheries, new marine industries, tourism, renewable energy and the mineral industry. We will also describe environmental challenges and area use with regard to resource extraction in each industry, and the possibilities for exploiting the resources in the long term.

Marine resources

The sea areas off Northern Norway are among the most productive in the world and provide a large resource base, which includes some of the largest fish stocks in Norway and the world. Northern Norway also offers good conditions for aquaculture, and by-products from both fisheries and aquaculture are important input factors in the marine ingredients industry. Unless explicitly specified otherwise in the text, this section is based on the knowledge-gathering project's *Sektoranalyse for de marine næringene i Nord-Norge* (Winther et al., 2013).

Fisheries

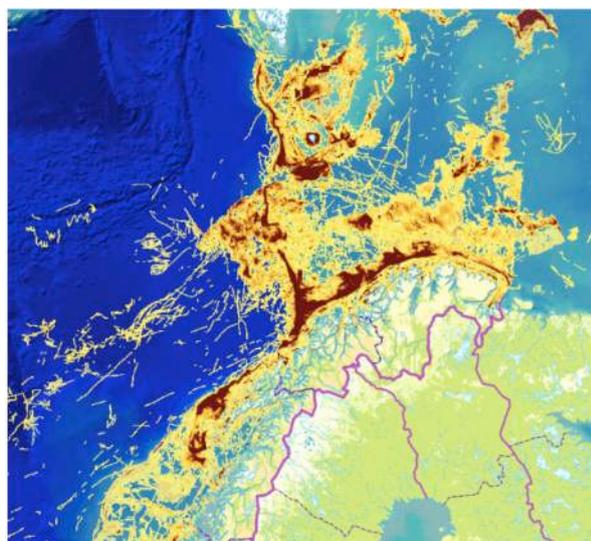
Northern Norway has a long tradition of fishing as an occupation. The most important fish species are cod, haddock, pollack, winter herring and capelin. The spawning stock of Northeast Atlantic cod, which is at a historical high, is considered to be one of the most important of the world's cod stocks. The large fish resources in the sea off Northern Norway are a classic example of a provisioning ecosystem service. It is a renewable resource that, with good management, can be harvested for the foreseeable future.

In order to safeguard this provisioning ecosystem service through sustainable management, Norwegian fisheries are currently regulated by quotas, which put a ceiling on how much biomass of each fish species can be caught. The quotas are fixed on the advice of researchers from the coastal states with an interest in managing the different stocks.

Approximately 1,458,000 tonnes of fish and shellfish with a value of NOK 10.8 billion were caught in the sea areas off Northern Norway in 2012. A breakdown of quantity and value can be found in Table 4.1.

Cod and cod-like fishes, together with pelagic fishes such as capelin and winter herring, are the most important commercial fish species caught in Northern Norway. These two fish groups account for 95% of the total quantity of fish and shellfish caught off Northern Norway. A total of 1,122,000 tonnes of wild-caught

FIGURE 4.1
Illustration of fishing activity in Northern Norway's waters in 2011 based on tracking data from the Directorate of Fisheries



Source: Screen dump from Barentswatch 7/2/2014

fish with a first-hand value of NOK 8.6 billion was landed in Northern Norway in 2012. This is equivalent to approximately 76% of the total tonnage of fish and shellfish caught in the sea areas off Northern Norway.

Aquaculture

It was long thought that the low sea temperatures in Northern Norway would not offer optimum conditions for farming marine fish. This assumption proved false. The ecosystem services in much of Northern Norway offer excellent conditions for the production of edible fish, and Nordland is one of the two main fish-farming counties in Norway (in terms of tonnes produced). There was a sharp increase in salmon and trout production between 2000 and 2012 in terms of both volume and value, and Northern Norway now accounts for 34% of national salmon and trout production.

TABLE 4.1
Catch volume and value for the sea areas off Northern Norway in 2012

FISH GROUP	TONNES CAUGHT	CATCH VALUE NOK '000
Cod and cod-like fishes	749,274	6,791,216
Pelagic fishes	640,929	2,970,746
Flatfishes and bottom-living fishes	47,193	553,574
Shellfish and molluscs	19,822	429,307
Deep-sea fishes	418	891
Other and unspecified fish	316	29,703

Source: Directorate of Fisheries

The resource base for aquaculture is largely about how much production capacity the industry is allowed to develop, which in turn is limited by environmental considerations. Capacity is controlled by means of licences (concessions) and localities, and regulation of how much biomass the producers can have per licence and per locality at any one time (biomass regulation).

Nordland is the county with the highest production and exploitation rate, while Finnmark has the least exploitation of sea area for aquaculture and lowest production per licence. This means that Finnmark still has potential for growth within the scope of current licences, whereas Nordland is more dependent on new licences being granted in order to increase production.

Over the years, access to new areas for aquaculture has been a recurring theme in discussions about the industry's long-term development opportunities. The aquaculture industry's localities currently occupy

14.9 square kilometres of sea area in Northern Norway, accounting for around 0.03% of the 45,865 square kilometres of sea area within the baseline in the three northernmost counties. It is important to point out that it is not necessarily the 'amount' of area, but rather the suitability of the areas and marine environment in terms of recipient capacity³, exposure, currents and temperature conditions that is the determining factor in production per unit of area.

How efficiently the area taken up is exploited is another important factor, however, and in this respect Northern Norway lags well behind the rest of the country. Whereas an average of 12.3 tonnes of fish per square kilometre was sold in the case of Norway in 2009, the corresponding figure for Northern Norway was 6.7 tonnes. Northern Norway therefore has both large sea areas available for aquaculture and great potential for increasing area efficiency.

Biomarine industry

The biomarine industry consists of a broad spectrum of businesses, but can be divided into two main groups based on the raw materials involved.

1. The marine ingredients industry exploits marine by-products to produce marine ingredients such as health foods, fish feed or biochemicals.
2. Marine biotechnology is normally dependent on materials from the fishing industry's value chain and its products have biochemical or pharmaceutical applications. Modern biotechnological methods mean that discoveries of interesting marine molecules or substances are no longer dependent on a 'coastal' location, and the most critical input factor is human capital.

From the point of view of natural resources, therefore, it is mainly relevant to examine the marine ingredients industry with regard to available resources.

³ Recipient capacity is the load (in the form of nutritive salt discharges, for example) that a body of water can cope with without the ecosystem being harmed.

Calculations carried out by Winther et al. (2013) – based on the raw materials landed in the region – show that 'in theory' there might be 358,000 tonnes of raw materials available in Northern Norway for further value creation by the biomarine industry. Substantial amounts of by-products from the cod fishing sector are not landed, however. Large quantities of semi-products are exported from the region for further processing and sale to the feed industry at home and abroad. Finnmark occupies a special position in that it currently has virtually no commercial activity in the marine ingredients industry, despite the fact that it receives a considerable volume of raw materials from fisheries and, to some extent, aquaculture.

At present, the marine ingredients industry is largely based on by-products from fisheries and aquaculture. The growth in aquaculture in Northern Norway has been an important element in growth in the biomarine industry too. This is because aquaculture has stable production, which traditional fisheries are unable to offer owing to seasonal fluctuations, and this in turn means a stable supply of by-products for the ingredients industry.

Environmental challenges

The impact of fishing, hunting and processing on the marine environment in Northern Norway is considerable as far as the extraction of biomass is concerned, but relatively limited in terms of the impact on the physical environment. Given sustainable management, the impact on the environment on the coast and in the sea areas off Northern Norway does not present any major challenges for the further development of fishing and hunting.

The greatest potential for improving the fishing industry's environmental value creation is to ensure that the unwanted extraction of biomass is minimised. It is also important to assess which species should be harvested and at what trophic level harvesting should take place, in other words what is the optimum solution in order to ensure sustainable, ecosystem-based harvesting. Fishing for resources that can be

used as a raw material in feed for the aquaculture industry is problematic, and further growth in aquaculture may require an increase in the extraction of marine raw materials for feed.

The environmental challenges within aquaculture in Northern Norway are largely the same as the national challenges. The most important are the impact on stocks of wild salmon from salmon lice in fish cages, fish escape from cages, and the spread of disease. However, the salmon louse situation is better in parts of Northern Norway than in the country as a whole. The use and occupation of areas are an important factor in assessing the environmental impact of fisheries and aquaculture. Theoretically, production could be increased substantially by having facilities closer together or larger facilities, but this would require problems such as fish escape and the spread of disease to be solved.

Long-term opportunities

Global development factors will play a major role in how Northern Norway harvests its marine resources in the future. In the final declaration on sustainable development from Rio+20 in 2012 it was pointed out for the first time in this forum that fisheries and aquaculture will be important in providing sufficient, healthy food for the world's population in the future. The sectoral analysis for the marine industries identifies four certain driving forces⁴ that will be important in terms of the development opportunities in marine industries. These are increased demand for food, increased focus on health, increased focus on environmental sustainability and increased demand for energy.⁵

It is likely that the large, rich sea areas off Northern Norway will still be productive in 2030 and 2050, with rich fish stocks that the fishing industry can harvest. There is great uncertainty with regard to how climate change will affect the resource base in the sea areas, however. On the one hand, climate change may have

⁴ Certain driving forces point in a particular direction. In other words, it is relatively certain what the outcome or effect will be.

⁵ Macroalgae (or kelp) can be used for energy by fermenting the carbohydrates to produce ethanol, butanol or methane.

a more positive impact on these sea areas than on many others. On the other hand, other uncertainty factors, such as ocean acidification, could have a negative impact on primary production.

The basis for all fishing is closely linked to the regulation of fish and shellfish extraction. If stocks are not overtaxed and the regulations optimise extraction, the amount of fish and shellfish harvested could be increased beyond what we see today. The bulk of the catch will still consist of marine whitefish, pelagic species, flatfish/bottom-living fish, shellfish and molluscs, but according to Winther et al. (2013), a larger number of species will be harvested in future as a result of ecosystem-based management. In the longer term this will provide a basis for a larger catch volume and smaller quota fluctuations from year to year.

Winther et al. (2013) is also of the opinion that rising sea temperatures will probably make Norway even more favourable for salmon farming in the years up to 2050. There is greater uncertainty in the even longer term, however, owing to both higher sea temperatures and other possible environmental challenges. There is much to suggest that more species will be farmed than is the case today, and in 2030 cod farming will probably have picked up, while live storage will have been systematised and become more widespread than it is now. If the high growth rate in the aquaculture industry is to continue, however, the current environmental problems will have to be solved.

In the years up to 2030 there is expected to be a diversification of production. Larger fish will be produced on land before being set out, self-contained systems will be built in the sea, and more exposed areas along the coast will be used for farming. Northern Norway also has great potential when it comes to making better use of the areas close to the coast, but society's ability to provide and prioritise areas for the industry will be very important in realising this potential. All in all, there is a good basis for increasing aquaculture production in the region. According to Winther et al. (2013), it is also probable that a larger proportion of farmed fish will be

filleted and processed in Northern Norway in the future, and that the region will exploit the by-products as a valuable raw material that will make the marine ingredients industry ever more profitable.

With its proximity to large fish resources and fish-farming industry, Northern Norway has access to high-quality by-products. In the years up to 2030 and 2050 the amount of by-products will increase, partly because all by-products will be landed and taken better care of, and partly because of increased production in the aquaculture industry. In the long term they will no longer be regarded as by-products, but products in their own right.

Northern Norway has the potential to play a leading role in *marine bioprospecting*, which entails exploring and exploiting the enormous biological and biochemical diversity found in marine microorganisms, plants and animals. This is a demanding field that will require long-term prioritisation of research and patience in the work of building up a robust industry. However, Northern Norway is well positioned thanks to its existing research institutions, such as the Tromsø branch of the Institute of Marine Research and UiT The Arctic University of Norway.

Kelp cultivation and Integrated Multi-Trophic Aquaculture (IMTA) are at an early stage of development in Norway. IMTA aims to produce kelp or other macroalgae and blue mussels in association with salmon farming facilities, for example, by exploiting nutritive salts and organic material discharged from the facilities. Northern Norway could also acquire a position in macroalgae (kelp) cultivation, which is already an emerging industry in Norway. Several *microalgae cultivation* projects have also been carried out under the auspices of the expert environment in Tromsø. The Finnjord smelting plant in Lenvik in Midt-Troms is working on CO₂ sequestration in connection with microalgae production. Organisms at a lower trophic level are another harvestable resource, with it being possible to use red feed (*Calanus finmarchicus*) to produce high-grade marine oil for human consumption.

Tourism's resources

Nature and cultural experiences

Tourism does not utilise natural resources in the traditional sense, but there is no doubt that Northern Norway's spectacular landscape is by far and away its most valuable tourism resource. The region has an abundance of nature: mountains, high plateaus, sky and coast, and world-class natural phenomena like the midnight sun and northern lights. These can be described as cultural ecosystem services and are an important component of investment in Northern Norway's tourism industry. Few other regions can offer equally varied and unique nature experiences, a number of national parks, rich animal and bird life, and a well-developed experience portfolio in all these areas. Unless explicitly specified otherwise in the text, this section is based on the knowledge-gathering project's *Sektoranalyse av reiselivsnæringen i Nord-Norge* (Enger et al., 2013a).

While nature is Northern Norway's greatest tourist draw, the region's scattered local communities are important for an attractive tourism industry. *Arctic*, *coastal* and, not least, *Sami* culture are all important building blocks that provide a framework for the nature experience, making it more unique and complete. Northern Norway is one of the most accessible Arctic destinations in the world, and is made more attractive by its relatively good infrastructure, service functions and cultural experiences.

The opportunity to experience Sami culture and cultural history is unique to Northern Norway. The Sami, Norway's indigenous people, live all over the country, but Sami traditions are most evident in Finnmark, especially in Karasjok and Kautokeino. According to Angell et al. (2014), the opportunities for tourism lie in increasing demand for emotional and knowledge-related elements in the tourist experience, and the report therefore concentrates on experience enterprises based on Sami culture, including museums, cultural institutions and events, as being important for future-oriented prioritisation of tourism. Enger et al. (2013a) points out that most providers of Sami cultural experiences operate on a small scale,

but there are exceptions like the Sami theme park, Sápmi, where tourists can see theatre productions, visit dwellings, taste Sami food and learn to throw a lasso. The Riddu Riđđu indigenous festival in Troms has gradually grown into one of the most important international indigenous festivals in Europe. Sami culture helps to differentiate Northern Norway's Arctic offerings from competitors such as Iceland and Greenland, which do not have Sami culture.

Cultural treasures can represent a direct resource for value creation in tourism. Myrvoll et al. (2013) describes in the report *Kulturminner og verdiskaping i Nord-Norge* how innovation in experience-based tourism is being promoted at Varanger Sami Museum, with a combination of natural and cultural heritage forming an important part of the product. There is optimism surrounding the further development of such prioritisation of tourism, and the potential is reckoned to be considerable. It is precisely experience and activity tourism, both summer and winter, that has grown most and been responsible for the largest growth in value creation in recent years. There is a wide range on offer: off-piste skiing and dog sledding, surfing, whale safaris, sea fishing, kayaking and much more.

Food experiences represent another important building block much in demand with tourists. Locally produced, high-quality food communicates the cultural history of hunting, fishing and cooking, raising the quality of the tourism product as a whole. The restaurants in the Arktisk Meny network have deliberately prioritised this area and offer Northern Norwegian dishes, use fresh, seasonal ingredients, and are dedicated to promoting Northern Norway's culinary culture. The regional ingredients mainly focused on are whale, reindeer, red king crab and air-dried fish.

Hurtigruten is one of the best-known international brands in the Norwegian tourism industry. It was founded back in 1893 and started a communication revolution, linking local communities along the coast of Northern Norway. Hurtigruten is now one of Northern Norway's most important tourist attractions,

but also a key basis provider for the rest of the tourism industry by virtue of both its transport function and its cooperation with a large number of experience suppliers on land.

Myrvoll et al. (2013) examined the extent to which World Heritage status can have a positive or negative impact on value creation in the tourism industry. One of the studies referred to (Reinius and Fredman, 2007) looked at the extent to which protected status in itself can attract visitors, and the results indicate that the national park category appears to have a greater impact on pulling power than World Heritage. This may be because the term *national park* is older and better known than the newer *World Heritage* category. Another study (Svels, 2011) points out that being granted World Heritage status is not enough to make an area a tourist attraction. Any tourism potential has to be realised in cooperation with regional and national tourism players. Studies from the World Heritage sites Falun (Cassel and Pashkevich, 2011) and Vega (Kaltenborn et al., 2013) show that the local population in these places supports World Heritage status and sees it as a development resource, particularly when it comes to developing sustainable tourism.

Environmental challenges

Tourism in the north makes extensive use of natural and cultural assets as a resource base. The impacts of visitor operations in tourism can be traced in the form of both physical impact on the natural infrastructure and changes in emissions to the surroundings from tourism activities. Impacts on the external environment can take the form of direct effects of primary tourism activities and/or indirect effects linked to resource use, support activities and transport. Preserving natural infrastructure is of central importance in being able to envisage tourism as a sustainable and renewable form of value creation.

Tourism activities entail extensive use of transport, common property and infrastructure. Transport mainly affects the environment through emissions of greenhouse gases and other pollutants. These emis-

sions can have a negative impact on local air quality, which in turn can harm people's health. Transport can also cause noise pollution. Other environmental impacts include impairment of water and soil quality, and intervention in nature, which can affect biodiversity and create physical barriers. Different forms of transport will have a different impact on the environment, however, and it is transport in connection with travel to and from destinations in particular that has the greatest impact. Walking and cycling are the most eco-friendly forms of transport.

Hotels and accommodation provision are an important activity in the tourism industry. Different types of accommodation impact on the environment to differing degrees, e.g. camping that leaves no trace and causes no pollution versus a high-class resort hotel. There will typically be large differences in terms of comfort level and the services on offer, not least owing to energy use. Food and eating out are also a key part of experiences and tourism, and the food will have an impact on the environment through the choice of production model (organic or intensive) and how local the food products are.

Experience production in tourism usually means traffic in forests and fields, at sea and in the mountains. This traffic in nature has an impact on natural assets. Different areas, types of vegetation and types of landscape have different impact tolerance thresholds. It is important for managers and users of nature to know how different types of activity affect natural and cultural assets, which areas are most vulnerable, and how the activity should be conducted in order to minimise its negative impact on nature.

Long-term opportunities

According to UNWTO (World Tourism Organisation)⁶, the strong driving forces represented by *increased globalisation, economic growth and demographic changes* will lead to growth in international tourism in the future too. Because Northern Norway's tourism product has great pulling power, the region should

⁶ Cited in Enger et al. (2013a)

also be able to share in this growth. One uncertainty factor is Norway's high cost level, however. This picture may change in the long term, though, as it is reasonable to assume that the differences in relation to price levels abroad will decrease in the longer term, making it cheaper, relatively speaking, for foreigners to choose Norway and Northern Norway.

There is great uncertainty surrounding how climate regulations and fuel prices may affect the tourism industry in Northern Norway. In general, however, it is possible to say that restrictions on travel or higher fuel costs may hit Northern Norway hard, as the region is a long way from the markets, has few alternative (more eco-friendly) means of transport, and possesses a small home market.

According to Enger et al. (2013a), the extent to which tourism will be seen as an important industry in itself or more as a part-time industry and means of rural development is both uncertain and significant. Political attitudes to tourism will be very important for the future of Northern Norway's tourism industry. The extent to which a framework is provided for it in the form of statutes and regulations, taxes and other policy instruments will have major consequences for how far the industry will be able to deliver quality products and so increase value creation, even with a high national cost level.

Renewable energy

Renewable energy production is based on converting the energy contained in various natural resources into usable energy such as electricity or heat. There is a lot of energy in Northern Norway's weather, and the theoretical resource potential for renewable energy in Northern Norway is huge. There are waterfalls and wind in abundance, but also waves, tides, thermal power and sun. However, the theoretical potential⁷ is only a reference value, not subject to the constraints

⁷ Theoretical potential means the amount of energy that could be obtained by exploiting the total resource in its entirety (e.g. all water flowing from the mountains to the sea). It will not be possible to develop the full theoretical potential for some of the technologies, as this would give rise to unacceptable conflicts with the environment, reindeer husbandry, fishing and other interests. The figure must therefore be regarded as a reference value.

of technological feasibility or environmental challenges. Unless explicitly specified otherwise in the text, this section is based on the knowledge-gathering project's *Sektoranalyse av fornybar energi i Nord-Norge* (Analyse & Strategi et al., 2013).

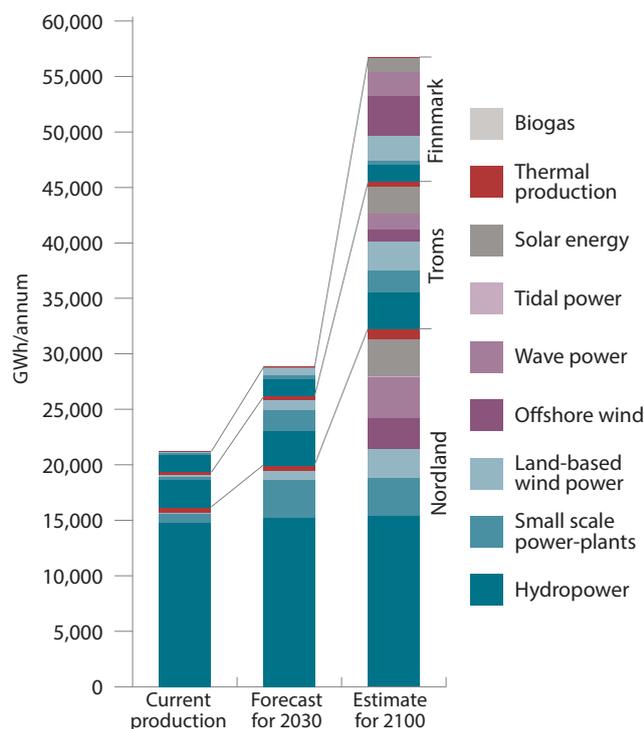
In a normal year, Northern Norway has estimated energy production in excess of 24,000 GWh (approx. 20% of total Norwegian energy production), while total energy consumption is around 19,000 GWh. This means that Northern Norway as a region normally has an energy surplus of around 5,000 GWh. Electricity of this order of magnitude cannot usually be stored, except in the case of regulated hydropower plants with reservoir capacity. Electricity has to be generated and consumed simultaneously, so if the power is not needed in the local area, it has to be sold and exported. The main grid in Northern Norway north of Ofoten is generally poor, but major investments are expected in the next few years. Although these investments will open the way for somewhat better power transmission, and with it increased renewable energy production, much greater investment will be required in the long term in order to provide for the large-scale expansion of renewable energy and power exports from Northern Norway.

The supply of renewable energy is not an ecosystem service, as it is not based on living (biotic) resources. However, the expansion of renewable energy may have a negative impact on ecosystem services and/or clash with other business interests. It is therefore extremely important to look at such expansion from an ecosystem service perspective and weigh different interests before any development takes place. The example study on offshore wind and prioritisation of tourism on the far side of Lofoten (Vista Analyse et al., 2013) shows how prioritisation of offshore wind could have negative consequences for regulating, cultural and provisioning ecosystem services alike.⁸

The technology and costs involved in the various forms of renewable energy production are a very important factor in the development and expansion of renewable energy.

⁸ See 4.1.1

FIGURE 4.2
Current production, forecast for 2030 and estimate for 2100 for various renewable resources in Northern Norway



Source: Multiconsult

Different technologies use different energy sources with widely varying efficiency, with hydropower technology currently being the most efficient. Based on expected revenue of NOK 0.55 per kWh for power plant owners in the years up to 2030, a possible increase in renewable energy production in Northern Norway in this time frame will come from hydropower and land-based wind power.

Figure 4.2 shows production today and forecasts for the medium (2030) and very long term (2100) for the technologies that, with today's knowledge, offer the greatest potential for Northern Norway. These are large hydropower plants (more than 10 MW), small hydropower plants (0.1-10 MW), land-based wind

power, wave power, tidal power, solar energy, thermal energy and biogas.

Environmental challenges

The expansion of renewable energy can have negative environmental impacts by affecting nature and the landscape. The type and severity of the impact depend on the technology being expanded.

The environmental consequences of hydropower expansion are linked to intervention in nature through raising or lowering the water level, destroying cultural treasures, changing water flow on stretches of river, and building roads and power lines. This can be detrimental to biological diversity, have an undesirable visual impact, and give rise to area conflicts.

Land-based wind farms have to be adapted to nature, landscape and settlement. The environmental challenges in the case of wind power are impact on biological diversity, visual impacts as a disruptive element in the landscape and in the form of shadows⁹, and acoustic noise. Wind farms can also clash with protected natural areas, cultural treasures and the cultural environment, outdoor life, hunting, fishing, grazing and other area use.

Offshore wind will cause fewer problems in the form of noise, shadows and visual impact on natural and cultural environments. However, large offshore wind farms can clash with migrating birds and business interests such as fisheries and petroleum. Experience-based knowledge in this area is still limited in Norway.

Wave and tidal power can be very visible in the landscape if located close to land or on the shore. Wave power plants at sea will probably have some ecological consequences both for biological life in the sea and shore erosion, but it is difficult to say whether they will be favourable or unfavourable.

⁹ The shadows from wind turbines will be most conspicuous when the sun is low in the sky, when they will be cast further than in the middle of the day. Shadows can be a problem for buildings if the wind turbines are relatively close to windows overlooking the wind farm.

The exploitation of solar energy using solar collectors or cells does not generate harmful emissions, causes little noise and requires relatively little energy for operation. The technology does need a surface to stand on, however, so the question of area is a potential challenge in so far as it becomes relevant to install solar cells and collectors on fields that can be cultivated and large land areas that are of interest to other industries too.

The environmental impacts of using bioenergy are more complicated than for other renewable energy sources in many ways. The most far-reaching and serious environmental impacts can arise in connection with the production and extraction of resources. There is a risk of reduced biodiversity and impairment of productive areas through erosion resulting from the large-scale production of biomass. There is also a risk of extensive user conflicts, including in relation to food production and the protection of natural resources.

Power lines are alien elements in the natural landscape and can be disfiguring. They can affect bird populations as a result of collision or electrocution through contact. The establishment of transmission rights of way in forests entails clearing trees, creating better conditions for scrub and ground vegetation. Where power transmission lines are installed in the form of underground cables, excavating and blasting trenches can affect hydrology and vegetation, as well as having consequences for cultural treasures.

Long-term opportunities

Around 94% of all Northern Norway's energy production currently comes from hydropower. A large proportion of the theoretical potential for exploiting hydropower in Northern Norway (around 70%) has already be utilised, so few new large-scale projects with regulation capacity are being built. Nor is the efficiency of the hydropower that has already been developed expected to increase much. Nordland has considerable potential for small hydropower plants and Statnett has plans to expand the grid in order to realise some of this potential. While the largest expansion of small-scale power plants is expected in Nord-

land, it is anticipated that there will be substantial development of land-based wind power in Finnmark.

Although Northern Norway is very rich in wind resources, not much wind power has been developed as yet. This situation may now be about to change owing to the common Swedish-Norwegian market for green certifications. As much as 46% of the available area in Norway with wind speeds in excess of 8 metres per second is located in Finnmark east of Lakselv. Land-based wind power is also a very area-intensive form of energy production. The hypothetical development of the 500,000 GWh making up theoretical potential for Finnmark would require 76% of the county's total area.

From the current perspective on technological development in renewable energy, several opportunities could open up for Northern Norway in the long term. The most important are offshore wind, wave power, tidal power, solar energy and thermal production.

The theoretical potential for *offshore wind* in Northern Norway is virtually unlimited, but extensive development will be required before the relevant technologies can be commercialised. According to the Ministry of Petroleum and Energy, the total potential for fixed-bottom wind power on the Norwegian continental shelf up to a depth of 60 metres is around 1,000,000 GWh per annum. If floating installations for sea depths of up to 400 metres are included, the potential is many times greater. Northern Norway has a large part of Norway's sea area and therefore considerable opportunities for such expansion. At the same time, several of the areas currently most suitable for offshore wind development are located along the coast, where conflicts of interest with both other industries and natural assets may arise.

Wave power is not a mature technology, although the first commercial installations are now starting to appear in the United Kingdom. In the case of Northern Norway it will be a particular challenge to build high-efficiency installations that are also robust enough to withstand winter storms. The report *Potensialstudie av havenergi i Norge* holds that it will be possible to develop between

12,000 and 30,000 GWh of wave power in Norway without giving rise to an unacceptable level of conflict with other sectors and interests (Sweco Grøner, 2007). It is reasonable to assume that at least 60% of these resources are located in Northern Norway.

Tidal power plants exploit the gravitational forces from the moon and the sun, which create waves by changing sea level over the course of 24 hours. Sweco Grøner (2007) maintains that the theoretical potential for tidal power in Norway is well in excess of 1,000 GWh, while the developable potential is much lower owing to conflicts with other interests such as the environment, fishing and shipping. Most of this potential is located in Northern Norway.

Solar energy is the term for the energy that the sun generates and gives off through radiation. The Northern Research Institute (Norut) in Narvik has carried out simulations that reveal considerable solar power potential in Northern Norway. Solar power could potentially supply 65 GWh/km², which is more than wind power. Southeastern Finnmark in particular is sunny, has a low temperature and is suitable for solar power.

The most significant *heat production resource*, which unlike waste incineration and waste heat must be seen as a natural resource, is bioenergy from forests. A recent report by the Norwegian Forest and Landscape Institute specifies the sustainable energy potential (regrowth) from productive areas in Troms and Nordland as 312,600 GWh per annum once biomass equivalent to around 82,400 GWh has been deducted for environmental reasons (Skog og landskap, 2012). The amount of biomass and energy potential represented by forests in Finnmark has not yet been calculated, but it will be lower for natural reasons. The growth and production of timber in Nordland and Troms is expected to double in the period 2015-2040, which will result in the total theoretical resource potential exceeding 600,000 GWh per annum.

Minerals

Northern Norway is extremely rich in minerals, especially those classified as ores and industrial minerals. These two raw material types are the heart of Northern Norway's mineral industry. Table 4.2 shows that Northern Norway (in reality Finnmark and Nordland)

TABLE 4.2
Total tonnes sold in 2011 by county and raw material type.

AREA	BUILDING MATERIALS	NATURAL STONE	INDUSTRIAL MINERALS	ORES	TOTAL
Finnmark	1,161,620	20,439	1,176,372	1,508,567	3,866,998
Troms	1,267,242	111	7,789	0	1,275,142
Nordland	3,492,785	1,322	3,616,653	996,000	8,106,760
Northern Norway	5,921,647	21,872	4,800,814	2,504,567	13,248,900
Norway as a whole	77,263,458	899,484	10,409,193	3,409,505	93,721,264

Source: Neeb and Brugmans (2012)

TABLE 4.3
Valuation of industrial mineral resources of national importance in Northern Norway and Norway as a whole. NOK billions

AREA	APATITE	DOLOMITE	GRAPHITE	LIMESTONE	QUARTZ	NEPHELINE	TALC	TOTAL
Finnmark					39.3	28		67.3
Nordland	5.8	19.1		100	10.0		15	149.9
Troms		1.5	7.4					8.9
Total resources, Northern Norway	5.8	20.6	7.4	100	49.3	28	15	226.1

Source: Boyd et al. (2012b)

is a very important region for the production of ores and industrial minerals. It accounts for 73% of national ore sales and 46% of national sales of industrial minerals. Building materials and natural stone are less important raw material types. Unless explicitly specified otherwise in the text, the discussion of mineral resources is based on *Sektoranalyse av mineralnæringen i Nord-Norge: Status og potensial mot 2030* (Vista Analyse and Sweco, 2013).

New mineral operations have consequences for the area and local community where they are located. There are frequently positive regional ripple effects in the form of new jobs and increased demand for local goods and services. At the same time, there will often be a negative impact on ecosystem services in the vicinity of mineral extraction. This is especially true of mining, with area requirements and waste dumping being of particular relevance. Vista Analyse et al. (2013), which looks at possible conflicts between mining and ecosystem services in Kvalsund, shows there to be negative consequences for supporting environmental services (marine environment and biological diversity), provisioning ecosystem services (reindeer husbandry,

marine fish) and cultural ecosystem services (landscape, outdoor life and cultural treasures).

Industrial minerals

Industrial minerals are used in many different products to give the end-product certain qualities, or they contribute to better production processes. Examples include use as fillers in paint, paper and plastics, and as the main components in ceramics, glass and cement. Dolomite, limestone and quartz are all examples of industrial minerals. Access to the world market is regarded as critical for a number of industrial minerals, and Norway's industrial mineral resources are therefore considered to be of strategic importance.

The largest deposits of industrial minerals are located in Nordland, where there are large dolomite and limestone reserves, see also Table 4.3.¹⁰ The quartz and quartzite deposits in Finnmark and Nordland are also

¹⁰ Deposits of national importance are defined by Boyd (2012b) as 1) deposits that are in operation and important for market needs and employment, 2) deposits where large tonnages of a quality that can be supposed to provide a basis for future operation have been documented, and 3) fields where there are deposits with clear indications of large tonnages of a quality that can be supposed to provide a basis for future operation.

among the largest in Norway (Boyd et al., 2012b). Norway's largest dolomite operation is at Hammerfall in Indre Salten, where 800,000 tonnes of dolomite are produced annually. Trælen in Senja is the only place in Western Europe to produce graphite, which has been defined as a critical mineral by an EU-appointed working group. Norway is also Europe's most important producer of ground limestone for use as a filler in paper, with the majority coming from Brønnøy Kalk. At Drag in Tysfjord The QUARTZ Corp produces high-purity quartz, which is used as a raw material in the production of solar cells, for example. Norway is also Western Europe's only producer of nepheline syenite, a rock used in the glass and ceramics industries.

Metal ores

Metal ores are rocks that are of economic interest owing to their metal content. There is most demand for iron, copper and gold on the world market. Lead, nickel and zinc are other examples of metal ores. Northern Norway is virtually the only place in Norway that noble metals (gold and silver) are found. A total of 88% of

metal ore production was exported in 2011 and the industry is highly exposed to fluctuations in the global market. Ore production often involves large-scale intervention in nature with clear lines of conflict with other stakeholders in areas where extraction is relevant.

Although there are large deposits of valuable metals in Northern Norway, there are just two places left with mines in operation. They are Sydvaranger Gruve at Bjørnevatn in the Municipality of Sør-Varanger in Finnmark and Rana Gruber at Ørtfjell in the Municipality of Rana in Nordland. The Bjørnevatn ore has been known about for nearly 150 years. The mine was shut down as uneconomic in 1997, but reopened in 2009. In 2011 the mine produced 4.2 million tonnes of ore and it is estimated that there are around 440 million tonnes of ore with a value of NOK 146.4 billion left in the mine.

Rana Gruber AS produced 3.3 million tonnes of iron ore in 2011. In the case of this mine the calculation of total deposits is more uncertain, but the company management has stated that they are at least 600 mil-

TABLE 4.4
Valuation of metal and ore resources of national importance in Northern Norway and Norway as a whole.
NOK billions

AREA	BASE METALS	IRON	NOBLE METALS	SPECIAL METALS	TOTAL
Finnmark	22.08	146.4	2.95		171.43
Nordland	11.37	272.1		1.75	285.22
Troms	1.92	15.66			17.58
Total resources, Northern Norway	35.37	434.2	2.95	1.75	474.21
Norway as a whole	136	1,224	2.95	22	1,388

Sources: Boyd et al. (2012a) and FODD (Fennoscandian Ore Deposit Database).

lion tonnes with a value of NOK 253.8 billion. The company wants to double ore production to around 6 million tonnes per annum.

In addition to mines in operation, there are other well-documented ore deposits in Northern Norway, see Table 4.4. There are plans to start up operations for the Nussir and Ulveryggen deposits (gold and copper) in Kvalsund. This would be on a scale of 1-2 million tonnes of ore per annum, making it Norway's biggest ever copper operation.

Natural stone and building materials

Turnover in Northern Norway in respect of natural stone and building materials is small in national terms. Natural stone is the designation for all stone that can be sawn, split or carved for use in buildings, monuments and outdoor areas. This segment makes up the smallest part of the industry and production is dominated by block stone, which is mainly exported. A good location near the coast is a competitive advantage that helps to make servicing the world market cost-effective, and in Northern Norway there is granite production in Nordland and some marble around Fauske. Building materials such as crushed stone and gravel are used in building and construction after being blasted from rock or extracted from loose masses/gravel deposits. Building materials are low-cost products and freight costs will account for a large proportion of the total cost if they are transported more than about 30 kilometres. This means that the markets for building materials are restricted to local demand.

Environmental challenges

The mineral industry has consequences for area use and an impact on the external environment in the vicinity of the operation. The environmental effects can be divided into pollution of air, soil and water, area use conflicts, conflicts with other industries and cultural conflicts. Mining in particular is susceptible to conflicts of various sorts owing to the type of operation, area requirements and, not least, dumping of waste materials.

The challenges with regard to area use, other industries and pollution vary from project to project and depend more on location (e.g. inland or coastal) than the mineral in question.

Area conflicts are dealt with in the development plan work for specific operations that are to be started or expanded/reopened. Relevant consequences are assessed either by means of consequence analyses or when the consequences of a draft development plan have to be described.

The area conflicts may be linked to natural environments in the form of impact on INON areas¹¹, reduction in wilderness areas used for outdoor activities, and impact on natural diversity. Conflicts can also relate to areas for other industries, including reindeer husbandry, agriculture, fisheries and aquaculture (dumping at sea in particular), and tourism. In Northern Norway the potential for conflict between the mineral industry and Sami reindeer husbandry is much greater than between the mineral industry and other land-based primary industries such as agriculture and forestry.

According to Angell et al. (2014), the extraction of minerals is an intervention that affects the traditional Sami industries, with there being the potential for area conflicts with reindeer husbandry in particular. The severity of a conflict of interests depends on the scope of the intervention, the importance of the areas in question, the extent to which the effects are direct or indirect, and whether those effects have a larger regional impact on the movement and grazing pattern of the entire reindeer herd.

Pollution from mineral operations includes the discharge of solids, liquids or gases that are or may be harmful to the environment. Noise and vibration are also regarded as pollution. The extraction of minerals frequently involves discharges into water as well. The most significant pollution sources will be associated

¹¹ INON areas (Areas without Major Infrastructure Development in Norway) are countryside that cannot be interfered with. They are defined as areas located one kilometre or more from major infrastructure development. (Norwegian Environmental Agency)

with run-off from quarry areas, dumping of waste materials and possible point source pollution from machinery and vehicles. Water pollution can occur in both open bodies of water, such as streams, water-courses, lakes and fjords, and groundwater.

Long-term opportunities

The mineral industry is dependent on an adequate, geographically delimited resource base for its activities. The location of the operation is dependent on the location of the resources and cannot be moved to other areas, of course. The assessment of future potential is therefore dependent on there being a known resource base that has been well enough mapped to make it possible to commence profitable operation.

Vista Analyse and Sweco et al. (2013) based its assessment of future potential for the mineral industry in Northern Norway on assessments and valuations of ore and industrial mineral resources by the Geological Survey of Norway (NGU). NGU's assessments provide a snapshot of the value of resources if they had been extracted and sold in their entirety 'today'. It is uncertain how long existing operations based on today's deposits can continue and the extent to which the enterprises can obtain licences to continue operations on nearby deposits. Based on NGU's data, Vista Analyse and Sweco (2013) assumes that there are sufficient resources associated with all existing enterprises to ensure operation at the current level until 2050. NGU's estimates and valuations of known reserves were used as a basis for brand new deposits. However, it is scarcely realistic to assume that all these will be extracted, even with very extensive changes in policy instruments. On the other hand, the geology of the north provides grounds for assuming that increased prospecting activity in the years to come will produce new finds that could be developed.

According to Vista Analyse and Sweco (2013), it is difficult to assess the potential for the mineral industry in the very long term (2050 to 2100), but the report says that the mapping of mineral resources in Northern Norway so far indicates that there are good possibilities for finding new resources that could

provide a basis for development. NGU also thinks it highly probable that there are mineral resources on the seabed, including along the Mid-Atlantic Ridge between Norway and Greenland, and in the Loki's Castle vent field, which is located at a depth of 2,300 metres 300 kilometres west of Bear Island.

4.2 Labour

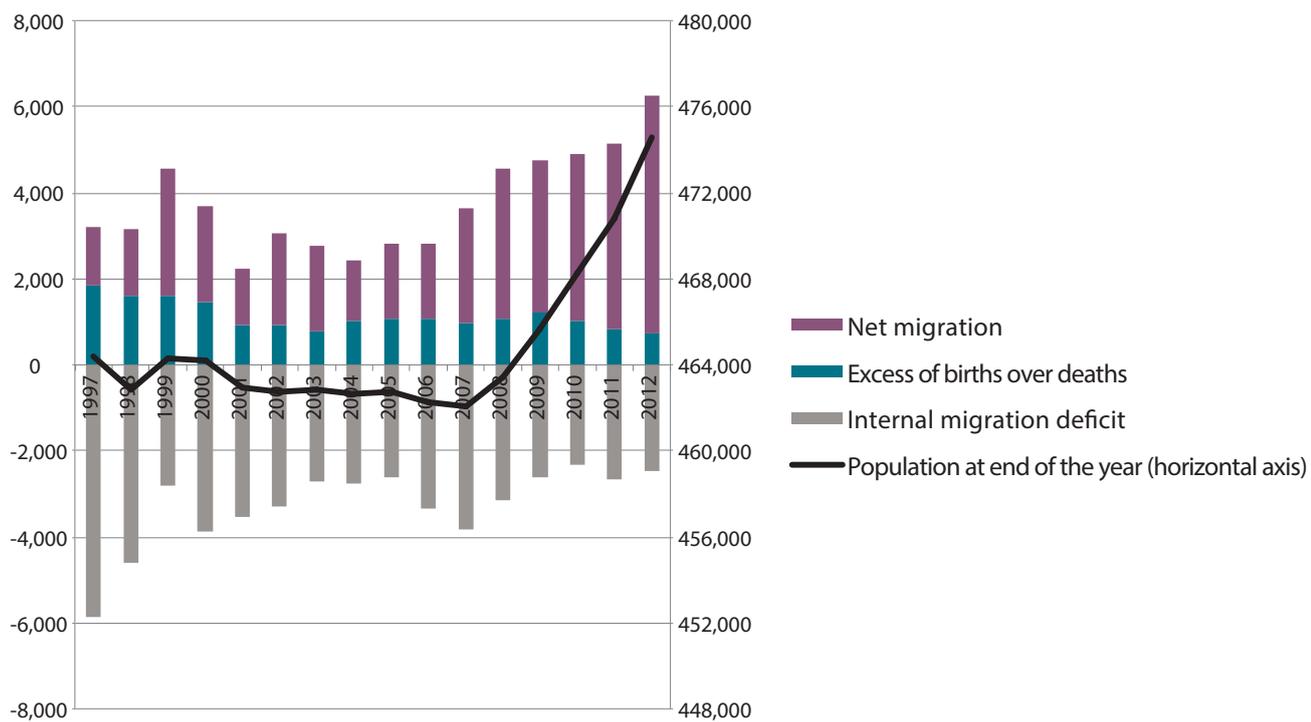
Northern Norway is often held up as a region of opportunity that is sitting on large, unexploited value creation potential owing to the extent of its natural resources. But the region lacks an important building block for exploiting that potential to the full: enough people. The imbalance between Northern Norway's natural resources and its population is illustrated by the fact that Northern Norway's population weighs just 1% of the total weight of cod that migrates to the Lofoton area every year to spawn. Northerners have around a third of Norway's total land area to frolic in, but represent just 9% of the country's population. Northern Norway is also characterised by long distances and a scattered settlement pattern. In the analysis *Attraktive lokalsamfunn og arbeidsmarked-regioner* Norut Alta takes an in-depth look at what the situation is today and what the future challenges for Northern Norway's local communities and areas may be with regard to population and employment (Angell et al., 2013). What are the population structure and population development like? How might things look in the future if industries experience growth and increase demand for labour? Are there sufficient people in Northern Norway to do the jobs that will have to be done?

Unless explicitly specified otherwise in the text, this section is based on *Attraktive lokalsamfunn og arbeidsmarked-regioner i Nord-Norge* (Angell et al., 2013).

4.2.1 Employment, population development and demography

Over the last 10 years employment in Northern Norway has increased and peaked for now at 240,000 employees in the last quarter of 2011. Between 2003 and 2011 employment increased by 7% in Northern Norway and 13% in Norway as a whole. Northern Norway saw strong growth in employment between 2005 and 2008,

FIGURE 4.3
Population changes and population at end of year in Northern Norway, 1997-2012



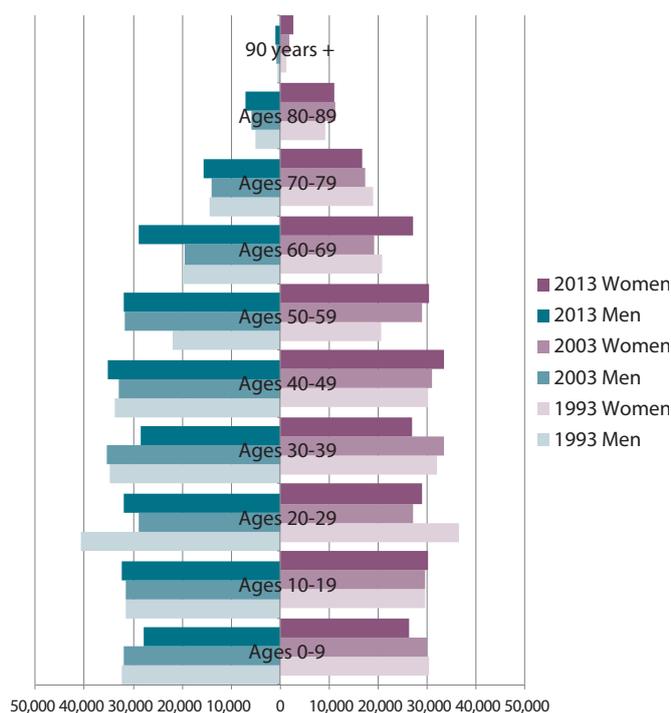
Source: Statistics Norway/Norut

which was largely covered by outside labour as a result of increased immigration from Southern Norway. In addition, outward commuting declined, participation in employment increased and unemployment fell to nearly the national average. This is particularly apparent in Finnmark, which historically has had the highest unemployment in Norway.

The growth in employment experienced in Northern Norway in the last 10 years is partly the result of population growth for the region. Having said that, population growth has always been lower than employment growth, and it is only in the last five years that the population has also grown as a consequence of increased immigration, see also Figure 4.3.

The increase in population of recent years is not evenly distributed geographically, with there being a distinct trend towards centralisation within Northern Norway. Positive population development has been experienced by three areas, Tromsø, Bodø and Vest-Finnmark (Hammerfest and Alta). These areas are so populous that they are pulling the entire region up. The biggest decline is being experienced by the more rural districts in Salten outside of Bodø, Nord-Troms and Øst-Finnmark. The most important reason for the urban areas growing, and what separates them from the rest of Northern Norway, is their reasonably high proportion of young adults. The age distribution of the population is very important for an area's growth potential, and in this respect the areas of the region

FIGURE 4.4
Population structure by age and sex in Northern Norway in 2013, 2003 and 1993



Source: Statistics Norway/Norut

with most scattered settlement in particular face major challenges.

There has been a general ageing of Northern Norway's population. This is partly because the proportion of young adults (29-30) has declined sharply. The proportion of the population in this group says a lot about the potential for population growth, with a low proportion meaning poorer chances of organic growth. In particular, the proportion of women in this group and the number of births have declined in Northern Norway. The population pyramid for Northern Norway is more 'top heavy' than in Southern Norway owing to less topping-up from below, but

also because of the net emigration of young people from north to south, see Figure 4.4.

According to Angell et al. (2014), key Sami settlement areas (the STN area)¹² have experienced a distinct decline in population in the last decade, although there has been a trend towards more stable population figures in recent years. These areas have also had an increased birth deficit, which is connected with the high proportion of middle-aged and older people in the population. So far immigration has made up for the birth deficit and internal migration deficit, and the situation in the STN area is very similar to that in other rural municipalities in the north.

4.2.2 Future labour requirements

Can business in Northern Norway increase its value creation on the basis of the current population structure and probable future population development? Angell et al. (2013) takes a detailed look at Northern Norway's future labour requirements, partly on the basis of the forecasts of future employment in the sectoral analyses and the public sector's future need for labour.

Forecasts are always uncertain, but Norut estimates that there will be a substantial increase in the need for labour in Northern Norway up to 2030. The sectoral analyses carried out as part of the knowledge-gathering project show that employment will increase, moderately with today's framework conditions, while some sectors will be able to achieve relatively high growth if better conditions are provided for value creation. At the same time, the grey wave and increased municipal responsibility for local health provision will mean a substantial labour requirement for health and social services in the public sector.

Another factor that is equally important in terms of future labour needs is the number of people expected to retire. In all, nearly 40% of the current labour force in the region will have retired in 2030, and ensuring that they are replaced will be a major challenge. New labour will have to cover both desired expansion in industry and the loss

¹² The STN area is the area covered by the Sami Parliament's Subsidy Schemes for Business Development.

of workers to retirement. With everything indicating that the demographic basis for organic growth will be weakened by there being fewer young and more older people, the growth set out in the sectoral analyses and reasonably moderate estimates of the public sector will be very difficult without massive labour immigration.

4.2.3 Competition for labour

If an industry is to achieve large growth in employment, it has to either attract people from other industries, activate people who are not already working, or bring in external labour through increased immigration or commuting (from Southern Norway or abroad). As participation in employment has increased in the region in recent years and outward commuting has declined, Northern Norway is left with labour immigration and increased competition between industries as real possibilities. Even with Statistics Norway's most positive forecast, which is based on high immigration, the increase in new workers will not be large enough to meet demand. Such high immigration will also present many local communities with major challenges with regard to both social inclusion and public services.

A shortage of and competition for labour will impede growth in some sectors in the Northern Norway of the future. Labour is a very important input factor in economic activity, but also a limited resource, and this means that not all industries can grow to their full potential at the same time and in the same place. There will be competition between industries, and the industries that are most profitable and can pay the highest wages will come out on top in the competition for workers.

4.2.4 Attractive local communities and labour market regions

Many municipalities in Northern Norway are currently finding it very difficult to recruit enough labour. The transition from a lack of jobs to a lack of people is reflected in both practical development work and scientific literature, where there has been a shift from job creation and business development to local development and image building in recent years. This shift is often described as going from a "business

climate" to a "people's climate". In some studies this means the focus moving away from work and business development in the traditional sense to other factors. Other studies maintain that work is still important for migration processes. As far as Northern Norway is concerned, this picture is probably complex. In many cases larger labour market regions within the region need people more than new jobs, while smaller places with a tighter, smaller labour market also need more jobs and more varied employment.

In particular, the knowledge-gathering project looked at two broad measures aimed at closing the gap between expected labour requirements and expected population development.

1. Attracting people by creating attractive local communities
2. Making labour regions larger to ensure better and more flexible labour market offerings with work for more people than is currently the case.

Attractive local communities

Making a local community or an area attractive is no simple task. Knowledge of what makes a place attractive, so that people want to live there, is still limited and many factors play a role.¹³ As far as local communities are concerned, the first challenge is to get people to come, and recruitment work and image building are of central importance in this respect. Angell et al. (2013) points out that there are a lot of local communities competing for the same people, and good project technique focused on concrete local challenges is important. Important messages and features to highlight include proximity to the countryside, leisure provision, varied housing provision, and varied work and career opportunities. A well-functioning housing market, good services and better infrastructure are also important factors when it comes to attracting new inhabitants.

¹³ By way of recent research in the field, Telemark Research Institute has done work on a programme theory for attractiveness that defines three different attractiveness dimensions: Attractiveness for businesses, visitors and settlement, see Vareide et al. (2013).

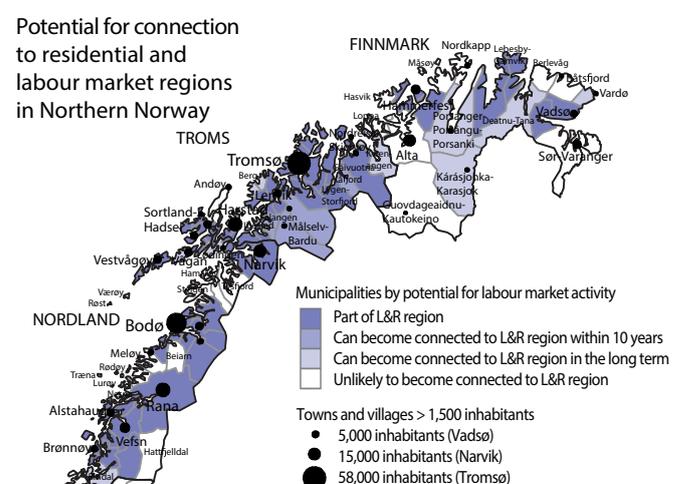
There is another challenge for local communities that is at least as important, however: getting people to stay. Both immigration from abroad and internal migration require there to be a welcome, and good inclusion in the labour market and local communities alike. Example studies carried out by Angell et al. (2013) show that it is precisely a local community's ability and willingness to include new inhabitants that is of decisive importance. The key to this is closely bound up with values and attitudes such as openness, tolerance and a desire for diversity. It is especially important to see immigrants and other groups on the peripheries of working life as a resource, as working life is a crucial factor in integration work. The voluntary sector is also an important arena for integration, while immigration can give the voluntary sector in a local community longed-for members and commitment.

The knowledge-gathering project also examined how cultural treasures and natural heritage impact on a place's attractiveness, and found in Unjárgga Gielda the Municipality of Nesseby a clear example of how the development of cultural and natural heritage can help to increase a local community's attractiveness and value creation. The analysis *Kulturminner og verdiskaping i Nord-Norge* (Myrvoll et al., 2013) takes a closer look at the possible value creation potential offered by some of Northern Norway's cultural treasures. One of the example studies is from Nesseby in Finnmark, where Varanger Sami Museum has become a powerhouse in the area. As well as contributing to skilled jobs and earnings, the establishment of the museum can be said to have given the area a growth boost that has prepared the ground for positive development, not least by making the area more attractive. The museum has acted as an activity-generating hub, and has led to other institutions setting up offices and creating jobs locally. Young people have moved back and settled down in their home area after completing their education, not least because there is now a real labour market in the municipality for people with higher education.

Well-functioning labour market regions?

Labour market regions that function well and are large enough can ensure a more varied labour market for the population, with it being possible to work in several different occupations and specialise in particular areas. In NOU 2011:3, *Kompetansesarbeidsplasser – drivkraft for vekst i hele landet*, the Skilled Jobs Committee shows that the largest labour market regions have seen the largest net immigration and employment growth in recent years. The growth of new skilled jobs is unevenly distributed geographically, and the committee believes that this is mainly because the main labour market regions have characteristics that make them attractive to competence-based enterprises requiring higher education. Therefore, the committee is of the opinion that work needs to be done on measures to create larger and more robust labour markets, and that "investments in communications that contribute to region enlargement are important in the development of robust labour markets that offer greater breadth and depth of job opportunities for people with higher education."

FIGURE 4.5
Potential for connection to residential and labour market regions in Northern Norway



Source: Norut

What opportunities are there for region enlargement in Northern Norway? The scattered settlement pattern in the region makes it difficult to implement effective measures to enlarge labour market regions in line with the committee's recommendations. The 87 municipalities currently in existence in Northern Norway represent a whole 51 residential and labour market regions, and the distances are mostly so great that large-scale prioritisation of enlarging the regions through infrastructure measures would have limited effect. There are currently infrastructure projects in progress in Helgeland, the Narvik/Harstad area and the Finnsnes area that will enlarge labour markets. The potential for connection to residential and labour market regions in Northern Norway is illustrated in Figure 4.5.

According to Angell et al. (2013), remote working, home offices and looser ties with the workplace are relevant in some industries and occupations. The option of weekly rota schemes also increases opportunities for commuting, but are only relevant in some industries and occupations, so would be limited in scope.

In all probability, Northern Norway will experience a shortage of and increased competition for labour in 2030, and this battle for people will be important for the region's development. Most of the areas in Northern Norway will continue to experience population decline and an ageing population. The people they may need to recruit will have to come from outside, from either Southern Norway or abroad. There will be competition between industries, areas and local communities to be an attractive employer and place to live, and to include and take care of the new inhabitants and workers. This is a difficult and long-term task that will be of importance for municipalities and employers alike.

4.3 Competence, R&D and innovation

As section 4.2 shows, labour will probably be in short supply in Northern Norway in the years up to 2030, which is precisely why the way in which the existing labour force is used will also be important. According to Damvad et al. (2013), boosting competence, research and innovation will mean more efficient use

of labour, more productive enterprises and increased economic value creation for both a country and a region. In previous studies in the Nordic Region, Damvad found a significant correlation between productivity growth and education, and is of the opinion that this is also true of Northern Norway. In the Business Tendency Survey for Northern Norway for spring 2013, 39% of enterprises say that lack of access to competent labour limits their production. This indicates that there is great potential for increased value creation in Northern Norway in ensuring enough competence of the right sort.

According to NOU 2011:3, around 10-15% new jobs are created in Norway every year, but nearly as many are cut. However, most of the new jobs created are different in nature to those cut in that they require greater competence. This shift is leading not just to industrial changes, but to geographical changes as well. It is towns, and the largest towns in particular, that have seen the largest increase in competence-intensive jobs in the past decade. The growth in new skilled jobs in Norway is not, therefore, evenly distributed geographically.

Some of the same driving forces are very much in evidence for important industries in Northern Norway. According to Damvad et al. (2013), both tourism and aquaculture in the region have problems retaining highly skilled labour. Both of these industries are based in rural areas and they are struggling with highly qualified labour preferring to live in central areas with better services. There are, however, large internal differences in Northern Norway, and the proportion of high-growth companies is not necessarily linked to high competence throughout the region. In Nordland and Finnmark the high-growth companies are spread out geographically, while in Troms there has been more centralisation of high-growth companies in the Municipality of Tromsø. Although competence is important, other factors are therefore also important for value creation, especially in the case of the tourism and seafood industries in Nordland and Finnmark.

TABLE 4.5
Formal educational level in Norway in 2010, all sectors

EDUCATIONAL LEVEL	NORTHERN NORWAY	REST OF NORWAY
Lower secondary	23.80%	18.90%
Upper secondary	43.40%	43.60%
Bachelor's	24.60%	25.90%
Master's	6.00%	8.50%
PhD	0.70%	0.80%
Unknown	1.60%	2.20%
Sample size	224,054	2,233,639

Source: Statistics Norway, DAMVAD

4.3.1 Upper secondary education and skilled workers

There has been a great deal of focus on the need for highly trained engineers in Northern Norway, but according to a sentiment study carried out for the Business Tendency Survey for Northern Norway in spring 2013, it is skilled workers who Northern Norway's enterprises highlight as being in short supply. In the survey, 73% of the enterprises struggling to obtain the right competence say that skilled workers are the hardest to come by. In the sectors under consideration in the knowledge-gathering project there is a need for competent labour at upper secondary level in fisheries and tourism in particular.

The reasons for the region's shortage of skilled workers are complex, and both upper secondary education and the industries must take their share of the blame. According to the Norwegian Labour and Welfare Administration (NAV), there is a shortage of apprenticeships in the region, something that the industries must

TABLE 4.6
Formal educational level in the private sector in Norway, 2010

EDUCATIONAL LEVEL	NORTHERN NORWAY	REST OF NORWAY
Lower secondary	31.00%	22.50%
Upper secondary	50.30%	49.30%
Bachelor's	12.50%	18.00%
Master's	3.60%	6.90%
PhD	0.30%	0.50%
Unknown	2.20%	2.70%
Sample size	127,940	1,488,064

Source: Statistics Norway, DAMVAD

tackle themselves. A particular problem facing Northern Norway is the throughput rate for upper secondary education, which is the lowest in Norway. Whereas 70% of all Norwegian young people complete upper secondary education, just 62% in Nordland, 63% in Troms and a mere 49% in Finnmark stay the course.

4.3.2 Higher education in Northern Norway

When Damvad et al. (2013) compares the overall educational level in Northern Norway with that in Norway as a whole, only small differences are apparent. The educational level is marginally lower in Northern Norway than in the rest of the country, see Table 4.5.

However, the small difference that is apparent between Northern Norway and the rest of the country in this overview conceals a larger difference in the private sector, where Northern Norway lags well behind. The proportion of people with higher education is all of 55% lower in the private sector in North-

ern Norway than in the same sector in the rest of the country, see Table 4.6.

Educational level is an important indicator of whether business is competitive or not, and the relative change in the region's educational level compared with the national educational level may therefore provide information on whether business in Northern Norway is going to be more or less competitive in the future. The *overall* educational level in Northern Norway is rising at the same rate as the level in Norway, but when the private sector is looked at in isolation, Northern Norway is in the process of catching up on the rest of Norway. The growth in formal competence in the private sector in Northern Norway is much higher than in the public sector, and the proportion of employees with a master's degree or doctorate is increasing faster than in the rest of Norway. While the proportion of employees with a master's degree or doctorate increased by 67% between 2000 and 2010 in Northern Norway, it rose by 55% in the same period in the rest of Norway.

4.3.3 Retaining competence

The number of students graduating from universities and colleges in Northern Norway is increasing, and more of them are choosing to stay in the region than is the case for students in other parts of Norway. At the same time, there are large differences within the region with regard to how many graduates stay, with the proportion being much lower for the smaller college towns than in the university towns. This may indicate that centralisation of skilled jobs is taking place in Northern Norway.

Meanwhile, applications to Northern Norway's universities and colleges are lower than in the rest of the country, and more students drop out too. The drop-out rate is highest at the colleges in Northern Norway's smaller urban areas. Despite applications and the completion rate being lower than nationally, there is a growing supply of highly qualified labour in Northern Norway. However, this increase is not large enough to cover both public and private sector demand for competent workers. It is not certain that the existing

educational institutions in Northern Norway will be able to close this gap, which is precisely where one of the big challenges for the region lies.

Competition for the best brains within the region is another challenge. Employment growth in Northern Norway is much higher in the public sector than in the private sector, and new employees with higher education are showing a strong preference for the public sector. It appears from this that the public sector is a strong competitor for private business in the battle for highly educated labour, which indicates that the private sector is not managing to be competitive when it comes to pay and conditions.

4.3.4 Research and innovation

Just as there is a significant correlation between education and productivity per employee, there is also a definite link between R&D intensity and value creation per employee in Norwegian enterprises. Increased innovative capacity, enhanced research in companies, and research cooperation between private business and universities are classic prerequisites for increased value creation, and, according to Damvad et al. (2013), there is no reason to suppose that such a correlation does not exist in Northern Norway too. But what is the situation in Northern Norway with regard to research and innovation?

Generally speaking, investment in both public and private research in Northern Norway is below the national average. Research in the region has nevertheless been given a considerable public boost in recent years. While the rest of the country experienced an increase in public research funding of 5% between 2007 and 2011, the increase in Northern Norway was all of 55%. However, there are large differences within the region, as shown in Table 4.7.

The figures show considerable skewing of where public research investment goes in the region, which may be adversely affecting opportunities to develop new knowledge in Nordland and Finnmark. The figures also reveal a lack of *private* research invest-

TABLE 4.7
Public and private research investment in 2011

	NORDLAND	TROMS	FINNMARK	NORWAY
Universities/colleges (NOKm)	216	1,372	63	14,353
Institutes (NOKm)	119	492	35	11,115
Business (NOKm)	214	187	3	20,066
Total R&D per inhabitant (NOK)	2,174	14,023	1,108	9,193

Source: NIFU

ment. During the same period as public research investment saw a substantial increase, private research investment fell by about 20% in Northern Norway. On a national basis, private investment in research increased by 5% in the same period. This means that enterprises in Northern Norway are losing innovative capacity and with it opportunities to develop new products, services and processes. Low investment in research also limits the capacity and ability of enterprises to gather and exploit new knowledge, including that developed by universities and colleges. Private R&D is a prerequisite if private enterprises are to benefit from public research funding, and an obstacle to increased value creation in the private sector in Northern Norway. Initiatives are now being taken to increase private research investment throughout Northern Norway, including through the Programme for Regional R&D and Innovation (VRI)¹⁴, the NORDSATSING initiative and a joint Northern Norwegian research fund to promote R&D activity.

¹⁴ VRI is the Research Council of Norway's special support mechanism for innovation through collaboration. It is intended to develop knowledge of and capacity for collaboration and innovation processes in the regions, and to encourage research-based innovation in Norwegian trade and industry by stimulating increased cooperation between R&D institutions, enterprises and regional authorities. (Source: Research Council of Norway)

The industrial structure of Northern Norway is a challenge when it comes to increased prioritisation of research and development, however. Northern Norway has a lot of small businesses that are located a long way from each other. As new ideas are generated more easily in larger environments, the shortage of environments with 'critical mass' is a problem for innovation work in Northern Norway. This industrial structure also means that there is an especially great need for networks and cooperation forums to promote R&D in Northern Norway. This in turn imposes requirements on the way policy instruments aimed at promoting innovation in business in Northern Norway are designed.

4.4 Infrastructure

Infrastructure is about accessibility, and accessibility is an important prerequisite for realising increased value creation, whatever the industrial sector. Northern Norway is a large region with scattered settlement and great natural resources. The region is a long way from the main markets both nationally and internationally, and faces great challenges in terms of transport solutions and transport provision both internally and into/out of the region. The knowledge-gathering project took an in-depth look at how

infrastructure affects value creation, what Northern Norway's infrastructure is like today, and what the plans are for improving it in the years up to 2030, including air, road, rail and sea transport, and access to electronic communication. Unless explicitly specified otherwise in the text, the discussion of transport infrastructure is based on *Transportinfrastruktur i Nord-Norge: Status, utviklingsplaner og betydning for verdiskaping* (Hansen et al., 2013).

4.4.1 Infrastructure's importance for value creation

A great deal of research has been done into the relationship between the quality of infrastructure and value creation in business, and the findings show that investments in infrastructure affect economic development. Such investments can result in shorter travelling times, lower transport costs and more efficient transport networks, which in turn can give business better market access, influence location decisions, make labour market regions bigger and provide better access to services.

But although the connection between investments in infrastructure and economic growth is often trotted out as an argument in favour of public investment, it is not as clear cut as might first appear. It is, for example, very difficult to say what an infrastructure measure like a new airport will mean for settlement, employment and business development in the area where the measure is implemented, among other things because the impact will be long term, and because development in the area over time will be influenced by a number of other factors that have little to do with the airport expansion itself. Good infrastructure is therefore *necessary*, but not *sufficient* in itself to realise value creation potential in an industry or area.

However, the connection between infrastructure investments and regional economic growth becomes clear and increases the possibility of economic benefit if:

- The infrastructure in the area is poor to begin with, especially if a key bottleneck is removed.

- The area has well-developed business with growth potential (e.g. through tourism development or exploitation of a localised natural resource).
- Transport infrastructure is critical for further development of business in the area.

Hansen et al. (2013) shows that several transport-related projects in Northern Norway fall within the above criteria. The capacity and quality of the existing road network, combined with constraints imposed by dependence on ferry services, place restrictions on the development of key rural industries, such as marine industries and tourism. Even with funding for improvements at a historical high, a number of bottlenecks will remain when the national transport plan comes to an end.

The following sections look at the status quo in the various sectors of transport infrastructure in Northern Norway, the needs and challenges of each sector, and what the sector may look like in 2030 if today's long-term plans are implemented.

4.4.2 Road network and ferries

The most important road transport corridor in Northern Norway is the E6, while the busiest roads are around the towns of Tromsø and Bodø. The quality of the national road network in Northern Norway is roughly on a par with road quality in the rest of Norway. There is, however, a substantial maintenance backlog on the national roads in Northern Norway, with the backlog per kilometre compared with the national average being worst in Nordland. The county road network is of roughly the same standard as the national average, but the maintenance backlog on the county roads is above the national average throughout the region. Compared with the current standard of Norwegian roads, general maintenance is the main challenge.

The ferries are such a key part of the road network in the north that the main E6 artery is dependent on a ferry connection between Bognes and Skarberget. This and several other key ferry links in the region are closed at night, making production logistics more complicated

and expensive for several seafood enterprises in particular. Many island communities are totally dependent on ferry provision. The fact that many of the ferries are starting to show their age is a general challenge with an impact on both comfort and reliability.

If today's long-term plans are implemented, the standard of the E6 will have seen a clear improvement in 2030, while Tysfjorden in Nordland will still have to be crossed by ferry. Several roads leading east will have been improved, and sections of road connected with major residential and labour market regions will have been shortened. Despite this, there will be a great deal left to do to bring the national and county road networks in Northern Norway up to an acceptable standard once current plans have been implemented.

4.4.3 Fairways, ports and Hurtigruten

Sea traffic in Northern Norway is expected to increase in the next few years, particularly in respect of ore and petroleum. The vessels that operate along the coast are getting ever larger, with deeper and wider fairways being required to ensure that they can manoeuvre safely. Area availability, depth, anchorage and road access are challenges for several of the trunk network ports in the region. Northern Norway's biggest port by far in terms of tonnes loaded and unloaded is Narvik, from where iron ore from LKAB's mines in Kiruna is shipped. Otherwise, Mo i Rana and Hammerfest are reasonably large bulk ports, while Bodø is the largest container port.

Hurtigruten is known as Highway 1 and has 11 vessels calling at 34 ports along the coast between Bergen and Kirkenes. Hurtigruten can be described as a composite product that combines a coastal service for transporting passengers and goods with experience cruises. Hurtigruten also carries substantial quantities of cargo along the coast, taking mainly food and other consumer goods north, and fish south.

In 2030 several fairways in the region will have been upgraded, improving safety and navigability. There will also have been investment in a number of termi-

nal and quay installations in several of the larger ports. Hurtigruten has a contract with the Ministry of Transport and Communications until 2019, after which it is uncertain what services the government will buy and what the operating concept will be.

4.4.4 Railways

There are two rail links in Northern Norway: the Nordland Line from Trondheim to Bodø and the Ofoten Line, which runs from Kiruna in Northern Sweden to Narvik. Apart from ore transport, the Ofoten Line is mainly used to take fish south and bring consumer goods north. Both railways are single track with long distances between passing loops, which limits both their capacity and punctuality. The Ofoten Line, however, has remote traffic management, which increases capacity and makes train operation safer. Work is in progress on introducing remote control on the Nordland Line too. Passenger transport by rail is important in the Bodø/Fauske commuting area and parts of Helgeland, where rail provision strengthens existing residential and labour market areas.

In 2030 the Nordland Line will have better capacity thanks to remote control and development of longer passing loops. It is also possible that work on electrification of the line will have started. As far as the Ofoten Line is concerned, it is assumed that capacity and traffic will have increased enormously, nor is it improbable that all or parts of this line will be double track.

4.4.5 Airports

More than half of Norway's airports are in Northern Norway, with 13 in Nordland, three in Troms and 11 in Finnmark, see Figure 4.6. New requirements on the part of the authorities, an airport upgrade backlog and anticipated traffic growth mean that there is a substantial need for investment in this transport sector. Among other things, the plane types used for the smallest airports have a limited service life and are expected to be phased out towards 2030. Many of the airports cannot be expanded or would not benefit from expansion. These circumstances have led to a discussion concerning the region's future airport

FIGURE 4.6
Airports in Norway.



Source: Avinor

structure, with the closure and merger of smaller airports to create main airports being a central topic.

The three largest airports in the region in terms of passenger numbers are Tromsø, Bodø and Harstad/Narvik. The direct flights between these airports and Oslo carry by far the most passengers. Within the region, Bodø-Tromsø and Hammerfest-Tromsø are important routes in addition to those carrying passengers into the hubs at Bodø and Tromsø.

In 2030 the runways at Sandnessjøen and Stokmarknes airports will have been extended to 1199 metres. In Helgeland, the existing airports at Mo i Rana and Mosjøen will have been closed and replaced by a new Polar Circle airport. After the Hålogaland Bridge cut travelling times between Narvik and Evenes, Narvik airport was closed too. A new airport has been built in Lofoten to replace the two smaller airports closed at Leknes and Svolvær, and Hammerfest has a new airport too.

4.4.6 Electronic communication

The large physical distances in Northern Norway mean that well-functioning electronic communication that helps to reduce distances can have more of an impact on this region, relatively speaking, than on more central areas. This is especially true of sectors and industries with large information and knowledge exchange requirements.

Basic broadband coverage in Northern Norway is currently lower than in the country as a whole. However, the proportion of households in Troms and Finnmark with access to the highest broadband capacity class is higher than in the country as a whole, while it is lower in Nordland. All commercial buildings in the region have access to basic broadband coverage.

Electronic communication technology is developing very rapidly, and it would be ambitious to predict what this infrastructure will look like in 2030. It is reasonably safe to say, however, that speed and capacity requirements will have continued to increase, and that, among other things, high-speed mobile

broadband will be available throughout the country in 2030.

4.5 Capital and ownership

4.5.1 What is access to capital like in Northern Norway?

One of the most important input factors for increased value creation and business development is capital. This is especially true of business based on natural resources, of which there is a great deal in Northern Norway. Of the industries looked at in the knowledge-gathering project, the mineral industry and renewable energy in particular are capital intensive.

Capital will flow to where the highest return is expected. According to Enger et al. (2013b), the flow of capital can primarily be linked to the return from different types of commercial activity, not to regions or geography. If a region has a different industrial structure, it will be its industrial structure, not its geographical character, that affects access to capital.

When asked in 2013 whether access to capital was a problem, business leaders in Northern Norway replied that they had not found it any harder to raise capital in the past year. According to Sparebank 1 Nord-Norge, the largest financial player in Northern Norway, profitable projects with competent ownership will always find finance – even in Northern Norway (Svein Randa, lecture, 17.04.2013). Broadly speaking, there are two ways of raising capital for business investments, equity and loan financing.

4.5.2 Equity and ownership

The degree of equity is closely linked to type of ownership. Ownership in Northern Norway is characterised by a much larger proportion of personally owned companies than is the case nationally. At the same time, the proportion of foreign ownership in Northern Norway is just a third of the level in the rest of Norway. According to Enger et al. (2013b), Northern Norway's ownership structure is a consequence of its industrial structure. Private ownership is high in the north because private ownership is traditionally high

in industries that are big there. This applies to seafood, building and construction, trade, maritime industry and tourism. Foreign ownership is highest in the petroleum and mineral industries, while there is a lot of public ownership in the renewable energy sector.

Equity is often needed by new businesses, which can have problems raising loans, and for high-risk projects where the risk/reward ratio makes loan financing difficult. The injection of new equity through share issues is frequently an important source of capital, with private equity in the form of seedcorn funding, venture capital and buyout funds being an important source of such new equity.¹⁵ The relatively small number of private equity funds that are active in Northern Norway have little capital at their disposal and do not play a very significant role in Northern Norway's economy.

The ownership structure in Northern Norway, with a high proportion of personally owned companies, can have both positive and negative consequences for business development in the region. Positive because local and regional ownership provides regional control, independent decision-making and regional investment competence. Negative because a low proportion of foreign ownership can also mean limited access to important resources and networks that can provide useful market competence, as well as increased vulnerability to market conditions. A possible solution may be to open the way for increased foreign ownership, while ensuring that regional control is maintained.

4.5.3 Loan financing

Banks are the commonest source of loan capital in business, and in 2011 they lent NOK 63.5 billion to businesses in Northern Norway. There was a sharp increase in lending between 2005 and 2011, though the increase was smaller than in the rest of the country.

¹⁵ These are funds that, in addition to capital, contribute competence and play an active role in the development and management of the companies in which they invest, but for a limited, predetermined period.

It is vital for business for the finance industry to function well, as its task is to channel capital from external owners of capital to where the capital will do most good by generating as much value creation as possible. The task of channelling capital requires excellent knowledge of relevant investment objects, so it is important for the finance industry to have top expertise when it comes to the region's business. Northern Norway is a region with an industrial structure quite different from that in the rest of the country, particularly in terms of its long distances and great natural resources. By being present and having in-depth knowledge of business in the region, the finance industry can help to start up profitable projects that might have come to nothing if the finance industry had screened relevant investment projects in less detail.

In this respect it may be a problem that in recent years the finance industry has been heavily engaged in digitalisation and efficiency improvements, with the result that it has less of a presence in rural areas than before, since settlement pattern is no longer a key factor in the location of banks. The banking sector is also becoming increasingly centralised. One example is Nordlandsbanken, which was taken over by DnB in 2002 and closed down as a separate operation 10 years later. It remains to be seen whether this will increase the information asymmetry between deposits and loans.

The banks are responsible for a large and important part of the flow of capital in Northern Norway, but there may be fewer possibilities for raising capital through the banks in the future. The banks now have increased capital requirements to improve their financial stability, as a result of which capital could become both more expensive and more risk averse. One alternative to financing through the banks is the bond market. The bond market is also generally perceived as more flexible and easier to combine with other types of capital raising. In reality, however, this market is only an alternative for the largest players in the region.

Companies in Northern Norway currently make little use of the opportunities offered by the bond market. Very few debenture loans have been granted in Northern Norway in the last 30 years compared with the rest of the country, with this market mainly being used by the big players in banking, finance, the public sector and the energy sector. There is nevertheless reason to believe that the bond market will become more important for business in Northern Norway in the future owing to the official requirements now being imposed with regard to bank equity.

4.5.4 Public policy instruments

The government's own 'tools for growth' play an important role in terms of access to capital for business in Northern Norway, especially in the case of early-stage capital, which is important for innovation and start-ups. The government's principal tools are Innovation Norway (IN) and SIVA – The Industrial Development Corporation of Norway. Innovation Norway's main purpose is to "promote profitable business development, to unleash the business opportunities of the regions". SIVA is the government's policy instrument for enabling ownership and development of businesses and business/knowledge environments throughout the country. It has "special responsibility for promoting growth capacity in rural areas".

As far as Northern Norway is concerned, Innovation Norway is an important player who injects capital, with as much as 30% of its lending being channelled to Northern Norway. Although the lending volumes are small, they play an important role because they also go to projects that the banks consider too risky. Innovation Norway possesses a number of general tools, such as seedcorn funds, low-risk loans and start-up grants, but also programmes aimed at specific industries, like the Marine Value Creation Programme. It has been decided that one of up to six new national seedcorn funds will be established in Northern Norway.

SIVA has special responsibility for industries and areas with poorer access to private capital. Through its subsidiary SIVA Eiendom Holding AS, SIVA invests in building and physical infrastructure for industrial activities and research/knowledge parks, and lowers the barriers to setting up where market mechanisms make this particularly demanding. In Northern Norway SIVA Eiendom Holding AS built several phases of Tromsø Science Park and is involved in production buildings at Andenes and at Kaldfjord near Tromsø, for example. The aim is that SIVA's investments should attract private capital and competence. SIVA's property operation is run commercially, with leases being signed on commercial terms.

5

Business in Northern Norway in 2011

Photo: Johan Wildhagen, Norwegian Seafood Council

And the wefts of the future are now working their way into the north-facing weave. The colour palette is being enlarged by people with different thoughts and ideas – and the competence and technology that make it all possible. Only in the last 50 years has the colourful tapestry of the north acquired new, central patterns. Side by side with the silver border woven from fish and people. There the fish cages, full to the brim with prime salmon, stand out in bright blue splendour. There adventurous Italians in RIBs and amorous Japanese dancing with the northern lights blaze a turquoise trail. There the new technology of the Arctic petroleum industry, renewable energy and mineral industry traces symbols in steel grey. All framed in the golden weft of experience-based knowledge and innovative strength that has always characterised the tapestry of the north.

Kriss Rokkan Iversen

If we are to assess future potential for value creation in Northern Norway, we first need to know how much value creation there is today. The knowledge-gathering project therefore made a point of collecting data on business as it stood in 2011. In this chapter we take a closer look at the following factors:

1. Economic value creation. This includes a description of the industries, with location of enterprises, ownership and employment, and economic key figures such as value creation and profitability.
2. Competence and innovation, which are an important basis for social value creation. Here we look at employee competence in the enterprises, important research institutions, and the extent to which the industry is engaged in R&D, innovation and cooperation with others.
3. Environmental impact in the form of emissions of CO₂ and other relevant greenhouse gases.¹

Industrial classification

The industries that we looked at in the knowledge-gathering project are fisheries, aquaculture and new marine industries (under the umbrella term of marine industries), tourism (including accommodation/catering, transport, experiences and agency services), minerals, and other industry and business. These industries are not necessarily clearly defined in official

¹ Other environmental challenges connected with the various industries are discussed in Chapter 4 Building blocks.

statistics², which may mean that the classification used here for the individual industry is not necessarily the same as that used in other reports describing roughly the same industry. Appendix 4 shows which NACE/SIC industries are included in each of the sectors analysed in the knowledge-gathering project.

5.1 Total economic value creation in the industries in question

Economic value creation expresses the economic added value that the individual enterprise and industry as a whole contributes to society. Put simply, this is the enterprise's earnings (turnover) less the costs of buying goods and services in production. In the knowledge-gathering project value creation was in principle measured as operating profit plus payroll costs, also known as gross product. Nationally, value creation is measured as gross domestic product (GDP). See Appendix 1 for a detailed definition of these terms.

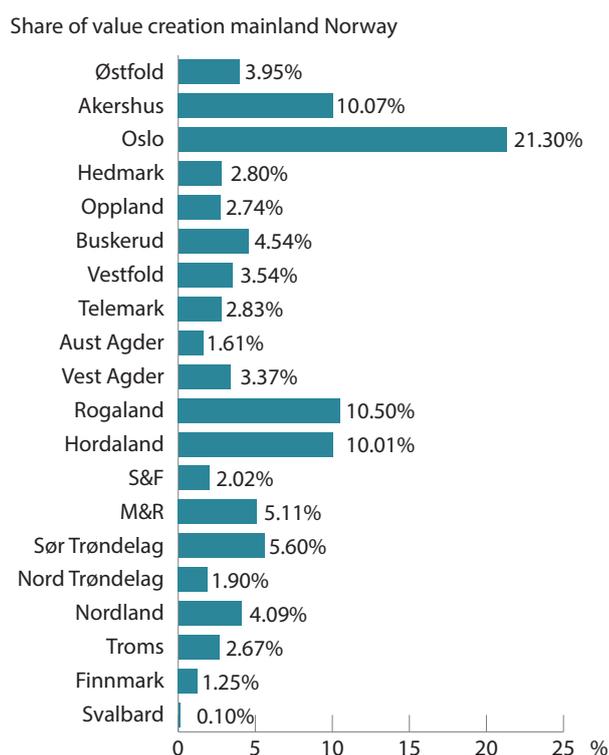
In total, the three counties of Northern Norway accounted for 6.4% of Norway's value creation in 2010, see Figure 5.1.³

The sectors analysed in the knowledge-gathering project account for a good 60% of total value creation

² There are no unambiguous and objective criteria for defining industries. If defining a group of enterprises as an industry is to be meaningful, there must be connections between them. In broad terms those connections can consist of similarities and complementarities. Industries can be defined on the basis of *input factors* (e.g. power-intensive industry), *product* (e.g. seafood), *activity/process* (either in the industry, e.g. fisheries and aquaculture, or on the part of the customer, e.g. tourism), *technology* (ICT) or *purpose* (defence industry). Official industrial statistics use an international system called NACE/SIC, where each industry has a unique description. The Norwegian industry classification standard (SN2007) is based on the equivalent EU standard (NACE Rev. 2).

³ This includes oil and gas production, which cannot really be divided between counties. If such production is excluded, Northern Norway's share of value creation increases to 8%.

FIGURE 5.1
Breakdown by county of value creation (GDP) in 2010



Source: Menon/Statistics Norway

(in terms of gross product) and a good 50% of employment in Northern Norway, see also Table 5.1.⁴ The remaining value creation and employment are accounted for by the public sector.

Northern Norway's share of value creation in Norway is especially high in fisheries, aquaculture and renewable energy, see Table 5.2. It is also higher than its share of total value creation in tourism, while the counties

⁴ The economic statistics for the individual industries in all the sectoral analyses are in principle based on accounting information from the Brønnøysund Register Centre, to which all companies in Norway with turnover of at least NOK 5 million must submit accounts. These figures miss out some smaller enterprises, but as their share of total value creation is small, this does not affect the overall assessment to any great extent.

TABLE 5.1
Value creation in the selected sectors in 2011

SECTOR	TURNOVER (NOK millions)	VALUE CREATION (NOK millions)	EMPLOYMENT	VALUE CREATION per employee (NOK)
Marine industries	28,668	10,258	11,269	910,285
Tourism industry	14,443	6,188	11,901	519,956
Renewable energy	16,893	6,000	2,724	2,202,643
Mineral industry	3,186	954	1,205	791,701
Other industry and business	194,159	61,878	98,130	630,572
Total for the sectors	257,349	85,278	125,229	680,976

Source: Sectoral analyses

of Northern Norway have relatively little production of private services and other industry. If oil and gas are left out of the equation, Nordland accounts for approximately 4% of national value creation overall. The corresponding figure for Troms is 2.7%, while Finnmark accounts for 1.2%.

Value creation for (any) one year does not necessarily paint an accurate picture of distribution between the different industries over time. Some industries are highly exposed to international economic conditions and can experience large fluctuations in turnover from year to year. This is true of the aquaculture industry, for example. The sectoral analyses and the discussion of the industries below show the development in value creation in recent years.

TABLE 5.2
The counties of Northern Norway's share of value creation by the industries, % 2010

	MARINE INDUSTRIES		TOURISM	RENEW- ABLE ENERGY	MINERAL INDUSTRY	OTHER INDUSTRY				TOTAL, EXCLUD- ING OIL & GAS
	Fisheries	Aquacul- ture				Oil & gas	Building & construction	Other industry	Private services	
Nordland	17	22	3.7	12.1	13.9	0	4.3	3.7	2.5	4.2
Troms	9.2	10.4	2.9	2.3	1.3	0.1	2.5	1.3	1.9	2.7
Finnmark	10.2	5.9	1.6	2.7	6.8	0.2	1.1	0.5	0.7	1.2
Northern Norway	36.4	38.3	8.1	17.1	22.1	0.2	7.9	5.5	5.2	8.2

Source: Menon/Statistics Norway

FIGURE 5.2
Value creation in selected industries in the three counties, NOK billions 2011



Source: Sectoral analyses

Figure 5.2 shows how the value creation in all the sectors apart from other industry and business is divided between the three counties. With the exception of the mineral industry, value creation is highest in Nordland, as is also the case for other industry and business. In part, this reflects the fact that Nordland has the largest population of the three counties.

In addition to looking at value creation, it is worth examining how profitable the individual industries are. The sectoral analyses look firstly at return on investment, which shows the return on the total capital tied up in the enterprise, and secondly at value creation per employee. Over time, return on investment should be at least as high as the interest rate on debt, see also Appendix 1 for a definition of the term. High value creation per employee may mean that the industry is lucrative, making it easier for enterprises to attract both investment and labour. High value creation per employee can also be linked to high capital intensity in an industry.

As Table 5.1 shows, mean value creation per employee in Northern Norway was NOK 680,976 in 2011. By way of comparison, mean value creation per employee for the

country as a whole was NOK 816,000 in 2011. But there are large variations in value creation per employee, from NOK 2.2 million in renewable energy to not quite NOK 520,000 in the tourism industry. The difference between renewable energy and the tourism industry is not simply due to renewable energy being a more profitable business, but is also the result of very low labour intensity combined with high capital intensity in renewable energy, while the opposite is the case for tourism. Looking at return on investment for these industries in the different areas in Northern Norway, tourism came in at between 0.4% and 12% in the period 2009-2011, while the corresponding figure for renewable energy was 5.1-18.1%. The return on investment figures reveal that although the difference in profitability between these industries is considerable, it is not quite as large as value creation per employee would suggest.

5.2 The marine industries

5.2.1 Description of the marine industries

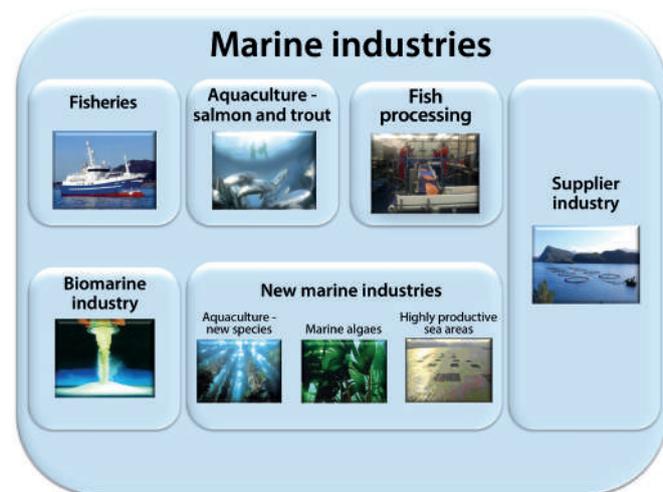
The marine industries, which are all based on the exploitation of renewable resources, are very important for Northern Norway. The knowledge-gathering project divides the marine industries into five sub-groups: fisheries, aquaculture, fish processing, biomarine industry and new marine industries, see also Figure 5.3. In addition, a large supplier industry is associated with all of the five individual industries. Unless specified otherwise, the discussion of the marine industries is based on Winther et al. (2013).

Fisheries

The resource base for the fishing industry is good, with stocks that are largely in a sustainable condition, see also Section 4.1.2. Approximately 1.5 million tonnes of fish and shellfish with a catch value of NOK 10.8 billion were caught in the sea areas off Northern Norway in 2012. Northern Norway's fleet was responsible for about half of this quantity. The two most important fish groups are cod/cod-like fishes and herring/capelin, which account for 95% of the catch.

The fishing fleet is made up of fishing vessels of varying size and age. In 2008 nearly 80% of the fleet

FIGURE 5.3
The marine industries



Source: SINTEF

consisted of vessels smaller than 11 metres, but these accounted for less than 10% of the total catch landed in Northern Norway in the same year. By contrast, the largest fishing vessels (over 28 metres) only made up a couple of percent of the fleet, but caught nearly half the total quantity.

Aquaculture

Aquaculture may be a young industry in Northern Norway, but it is growing rapidly. Growth in salmon and trout production has averaged 8.5% over the last nine years. In 2012 production was 459,000 tonnes, equivalent to 37% of total volume in Norway. Nordland is the biggest aquaculture county in the north with more than half of Northern Norway's production (230,000 tonnes), followed by Troms (139,000 tonnes) and Finnmark (89,000 tonnes).⁵ There is little further

⁵ These figures have been updated compared with those presented in Winther et al. (2013). They are taken from the Directorate of Fisheries' key figures for the aquaculture industry in 2012.

processing of salmon and trout, with more than 80% being sold as cleaned fish.

New marine industries

New marine industries include activities such as farming species other than salmon and trout (cod, halibut, mussels, shellfish, etc.), cultivating kelp and microalgae, and harvesting organisms at a lower trophic level. Generally speaking, there is little commercial activity in these segments in Northern Norway, but there are strong R&D environments, particularly in Tromsø. Cod farming grew steadily up until 2012, but has since been in sharp decline. There are now only a few players left both nationally and in Northern Norway. The farming of fish species other than cod and the cultivation of shellfish and other organisms are at a very low level.

Fish processing

Fish processing has a long history in Northern Norway, but the industry has undergone major restructuring in recent years, with the number of enterprises being greatly reduced. The fish processing industry can be divided into several segments, including the processing of farmed fish, the processing of wild fish and fish wholesalers.

The processing of farmed fish is generally an integral part of an aquaculture company, which can cover everything from egg production to sales and export. Approximately 370,000 tonnes of salmon were slaughtered in Northern Norway in 2010, but only 20,500 tonnes underwent further processing in the region, equivalent to a further processing rate of 5.5%. Nationally, the further processing rate varies between 15 and 20%. There has long been a desire to increase the further processing rate locally, and local processing has been a requirement for licence applications in recent years.

Wild fish are increasingly being processed by separate companies unconnected with the fishing boat that supplies the fish. This industry faces a number of challenges to do with large annual and seasonal fluctuations in the availability of raw materials, as it is based on wild

marine resources subject to more or less natural variations. Pelagic fish species (herring and capelin) go for meal/oil production and consumption, with the proportion used for consumption increasing in recent years. Landed whitefish (cod and cod-like fishes) goes for fillet production, conventional fish processing (e.g. clipfish, cod, salted fish, dried fish) or is sold unprocessed. The proportion used for fillet production fell from 23% in 2013 to 15% in 2011. The proportion used to produce clipfish, salted fish and dried fish was relatively stable in the period 2003-2011 at approximately 45%. The proportion sold unprocessed increased substantially from just under 30% in 2003 to nearly 40% in 2011.

Biomarine industry

The biomarine industry is made up of a broad spectrum of enterprises, but divides roughly into two main groups: the marine ingredients industry and marine biotechnology, see section 4.1.2. Marine bioprospecting, which involves searching systematically for components, bioactive compounds or genes in marine organisms, also forms part of this segment. Marine biotechnology and bioprospecting are being exploited commercially to such a small extent as yet that no figures can be presented for their value creation and profitability.

As mentioned in Chapter 4, the aquaculture industry is an important supplier to the biomarine industry, and this is reflected in the fact that this industry has become established in Nordland and Troms so far, while Finnmark did not have any such enterprises at the start of 2013.

Supplier industry

The supplier industry for the marine industries is very broad and supplies all the goods and services needed to either harvest or produce marine products. It is an important part of the seafood industry in Norway and Northern Norway. The goods and services supplied run from financial services, trade, postal and telecom services to fish feed production, transport, machinery and construction, and from goods and services required by any business to classic seafood industry suppliers.

The supplier industry for the marine industries is not as well developed in Northern Norway as in the rest of the country. At the same time, there are substantial sales by the supplier industry in Northern Norway to players in the marine industries in Northern Norway. For example, in 2011 the aquaculture industry in Troms bought goods worth NOK 3 billion, 85% of them from Northern Norway. The supplier industry is also regarded as a key factor when it comes to innovation in the marine industries.

Where are the marine industries located?

More than half of the enterprises in the marine industries are located in Nordland, while roughly a quarter are located in Troms and Finnmark respectively. Enterprises in Lofoten and Vesterålen make up the largest proportion overall, particularly in fisheries, fish processing and fish wholesalers. The area has 30% of all the enterprises combined, and 30% and 29% respectively of all the enterprises in the fishing

industry and fish processing. When it comes to the aquaculture industry, Helgeland has the largest number of enterprises, followed by Salten.

Who owns the marine enterprises?

Generally speaking, Northern Norwegian ownership in the marine industry declines the further north you go and is lower in areas with large urban centres.

Fisheries have a high proportion of local ownership, with the exception of Vest-Finnmark. In both Troms and Nordland Northern Norwegian ownership is in excess of 95%. Local ownership is also very high in *fish processing*, especially in Lofoten/Vesterålen at 84%, which affects the figures for Nordland as a whole. In Øst-Finnmark, Nord-Troms, Salten and Helgeland less than a third of the capital in fish processing is under local control. In Finnmark Northern Norwegian ownership is 49% overall, while in Troms it is 67%. In *aquaculture*, on the other hand, less than a third of

TABLE 5.3
Overall key figures for the marine industries in Northern Norway, 2011.

INDUSTRIES	NUMBER OF EMPLOYEES	NUMBER OF ENTERPRISES	TURNOVER NOK millions	PAYROLL COSTS, NOK millions	VALUE CREATION, NOK millions	VALUE CREATION PER EMPLOYEE NOK '000
Fisheries	4,655	3,082	5,835	351	4,390	943
Aquaculture	2,184	240	10,348	1,163	2,726	1,248
Fish processing	3,856	231	10,825 ¹	1,536	2,714	704
Fish wholesalers	308	126	751	167	212	689
Biomarine industry	166	24	910	171	216	1,296
TOTAL Northern Norway	11,169	3,703	28,668	3,388	10,258	920

¹ Production value instead of turnover in order to avoid counting twice, as the products generate turnover at several stages.

Source: Statistics Norway and SINTEF

the capital in Midt-Troms, Tromsø and Finnmark is under Northern Norwegian control. In Finnmark as little as 2% of capital is in Northern Norwegian hands, while the corresponding figures for Troms and Nordland are 32% and 83% respectively.

The fact that stakeholders outside Northern Norway have limited control of the capital in fisheries does not prevent them from taking part in fisheries in Northern Norway and thereby exploiting Northern Norway's resource base. Therefore, control of the capital base is not necessarily a good measure of control of local raw material resources, as the capital in fisheries is (for the most part) a mobile fleet, while the capital in aquaculture is (for the most part) linked to facilities in a specific geographical location.

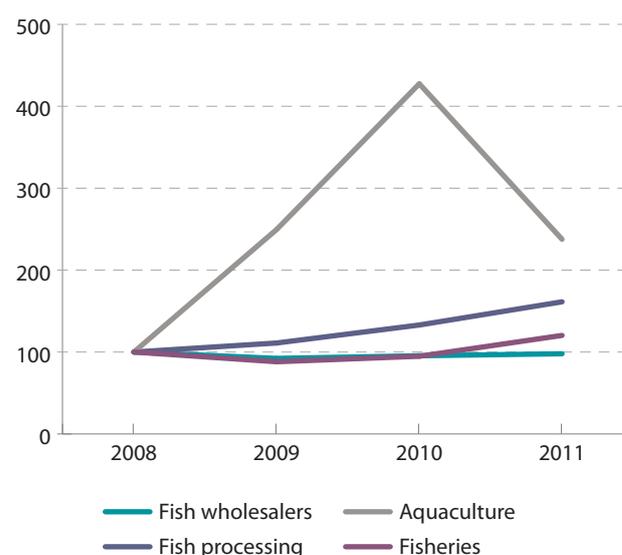
In the *biomarine industry* a considerable amount of equity and loan capital has been invested in building up the industry, which has combined assets in excess of NOK 1 billion. The equity ratio was a good 46% on average in 2011, which is high compared with other industry. The probable explanation is that this type of industry is much more dependent on risk-taking capital (venture capital) at the development stage.

5.2.2 Economic key figures for the marine industries

The marine industries had total *turnover* of NOK 28.7 billion in 2011, see Table 5.3. Aquaculture and fish processing had the highest turnover, with NOK 10.3 and 10.8 billion respectively. *Payroll costs* amounted to NOK 3.4 billion in 2011. Fish processing had the highest payroll costs, closely followed by the aquaculture industry. In the case of fisheries the level of payroll costs does not fully reflect what the fishers are actually paid, as most of their pay packet is in the form of a cut⁶. Total *value creation* in 2011 was NOK 10.3 billion, equivalent to 0.4% of that year's GDP. Mean value creation per employee in the marine industries as a whole was NOK 920,000 in 2011.

6 A cut is a share in the financial return on the fish. Cuts are calculated as a certain percentage of the gross value of the catch less operating costs for the individual trip, in other words the net value of the catch (NOU 2012:18, Rett om bord).

FIGURE 5.4
Development in value creation for the marine industries 2008-2011. Indexed growth, 2008=100.



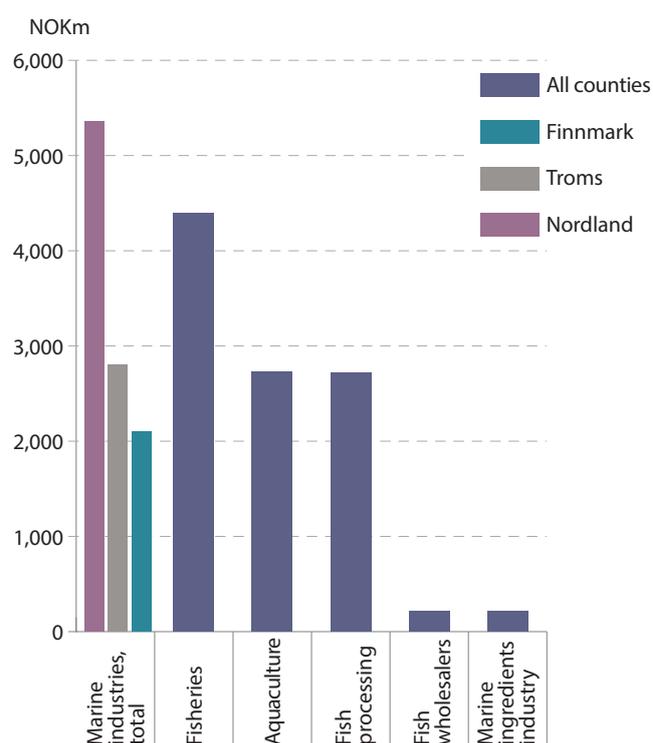
Source: SINTEF

Value creation in the marine industries increased from NOK 6.4 to 10.3 billion in the period 2008-2011, equivalent to real growth of around 52%, see Figure 5.4.⁷ Growth in GDP during the same period was 7.4%. Wage costs grew 38% in the period, while employment was stable with virtually zero growth. The increase in value creation and turnover is primarily due to increased volume in the aquaculture industry and price levels. The decline in value creation in the aquaculture industry from 2010 to 2011 is due to sharply falling export prices in 2011. Development in fisheries and fish processing was relatively stable, with growth from 2010 to 2011.

If value creation is broken down by county, Figure 5.5 shows that Nordland had the highest value creation

7 In Winther et al. (2013) growth is presented in nominal prices (current prices). In the final reports growth is expressed in real prices, with the nominal prices being deflated using the consumer price index.

FIGURE 5.5
Value creation in the marine industries by sector and county, 2011



Source: SINTEF

in 2011 and Finnmark the lowest. Nordland's share of both total value creation and employment was 52% in 2011, while Troms's shares were 27% and 26% respectively.

Value creation in the individual industries

As Figure 5.4 shows, value creation in *fisheries* varies a good deal from year to year. For the period 2008-2011 the last year was a bumper one, with the industry contributing NOK 4.4 billion, while 2009 was the worst with around NOK 3.0 billion. Value creation in 2012 is expected to be somewhat lower than in 2011 owing to lower fish prices. Value creation per employee

varied from NOK 595,000 in 2009 to NOK 943,000 in 2011. This latter figure is well above the national average for all industries, which was NOK 816,000 in 2011.

There is also considerable variation in value creation from year to year in *aquaculture*. The cost of production has been stable at around NOK 20 for many years, so value creation is strongly correlated with the price of salmon. The price of salmon was high throughout 2010 before falling sharply in the second half of 2011.⁸ In 2013 the price of salmon was at its highest since 1988 (SSB, 2014). Value creation was nearly NOK 5 billion in 2010, but nearly halved to NOK 2.7 billion the year after. Record high value creation is expected in 2013.⁹ Value creation per employee varied from NOK 0.6 million to NOK 2.4 million in the period 2008-2011.

Value creation in *fish processing* was NOK 2.7 billion in 2011, with a fairly steady increase from 2008. Value creation per employee varied from NOK 0.43 million in 2008 to around NOK 0.7 million in 2011.

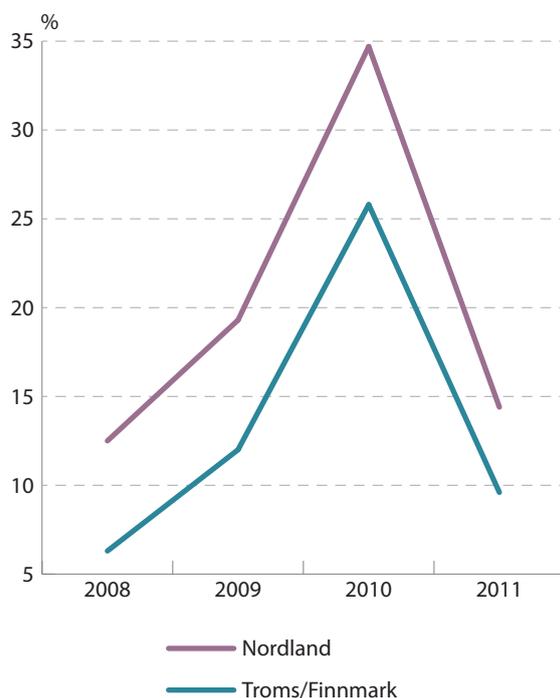
Based on accounts for a selection of companies, value creation in the *biomarine industry* has been calculated at NOK 216 million in 2011. The companies saw a substantial increase in turnover of 133% in the period 2007-2011.

It is difficult to separate out value creation by *suppliers* to the marine industries. Previous ripple effect analyses of the Norwegian fishing and aquaculture industries show that the ripple effects created by purchasing on the part of seafood enterprises in Northern Norway were approximately NOK 6.2 billion (contribution to GDP) and represented approximately 7,400 full-time equivalents on a national basis (Sandberg et al., 2012). It is assumed that NOK 1.8 billion, or 30%, of this NOK 6.2 billion represents ripple effects in Northern Norway. In addition to the value creation generated by

⁸ The fall is due partly to the economic situation in several important markets, but also to expectations of increased supply in the form of large quantities of Chilean salmon.

⁹ See, for example, the quarterly reports for the last quarter of 2013 for Lerøy (www.leroyseafoods.com) and Marine Harvest (www.marineharvest.com).

FIGURE 5.6
Profitability in edible fish production. Mean return on investment 2008-2011 for Finnmark/Troms and Nordland



Source: SINTEF

purchasing on the part of the seafood industry in Northern Norway, Northern Norway's supplier industry also supplies services to the seafood industry in other parts of the country and internationally. The extent of this business has not been quantified, but, based on a rough calculation of the total supplier industry in Northern Norway, is estimated to represent value creation of approximately NOK 4 billion, turnover of approximately NOK 10.5 billion and approximately 4,400 employees in 2011.

Owing to very low commercial activity in *new marine industries*, it is not possible to present figures for either their value creation or profitability.

How profitable are the marine industries?

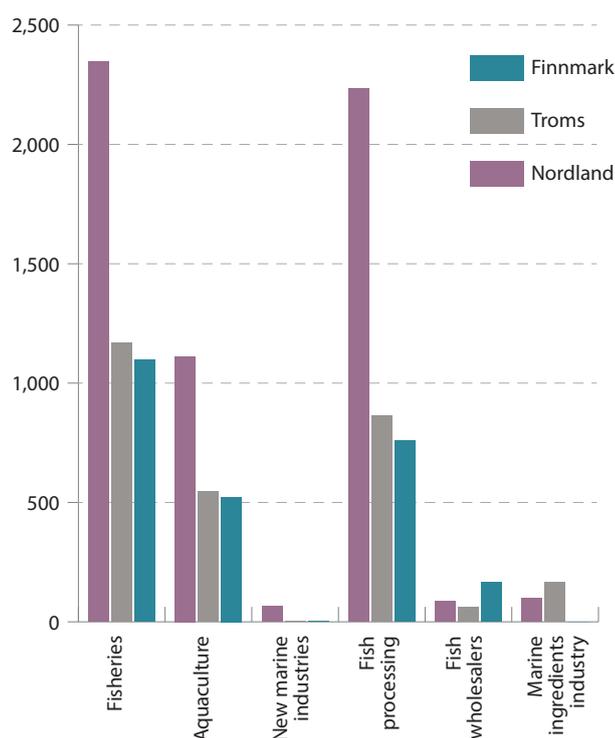
The Directorate of Fisheries publishes an annual overview of the profitability of the *fishing fleet* in Norway. Figures are available at county level for the years 2003-2008, and during this period the profitability of the fishing fleet in Nordland, Troms and Finnmark followed the mean for the fleet nationally. In the period 2003-2011 the high-sea fishing fleet at national level had higher mean profitability than the coastal fishing fleet, with the difference increasing after 2008. The profitability of coastal fishing vessels varies widely from boat to boat, and although profitability is low for the fleet group as a whole, there are also some boats with good profitability.

The long-term picture is that the *aquaculture industry* has enjoyed very good results. There was, however, a fall in profitability from 2010 to 2011 owing to more difficult market conditions in 2011, see Figure 5.6. The decline continued in 2012 (Fiskeridirektoratet, 2013), but, as indicated above, the industry probably had its best year ever in 2013. The producers in Nordland are doing very well and show operating margins and earnings per kg well above the mean for the industry in the country as a whole. Finnmark and Troms are slightly below the national average, which is largely due to less efficient production in Finnmark, with this in turn being linked in large part to natural conditions (water temperature and light).

Generally speaking, profitability in the *fish processing industry* has been variable over a long period. Much of the industry has undergone radical rationalisation and restructuring, and there has been a substantial fall in the number of enterprises. Profitability in the white-fish industry has been low over time, especially in the fillet industry.

For many of the enterprises in the *biomarine industry* profitability during the period was unsatisfactory, with a negative operating margin of 3% in the last five years. One of the reasons for this is that most biotechnology enterprises in particular only take saleable products to market after several years of testing and

FIGURE 5.7
Employment in the marine industries by county and sector, 2011¹.



¹ In the case of new marine industries the statistics only show Troms and Finnmark combined, so the figure has been divided equally between the two counties.

Source: Statistics Norway, Directorate of Fisheries, SINTEF

documentation. 'Patient capital' therefore dictates how long an enterprise can carry out R&D without satisfactory earnings. There is enormous variation between individual enterprises, however, with the most profitable having a mean operating margin of 23%.

How many people and who do the marine industries employ?

Total employment in the marine industries in Northern Norway was approximately 11,200 people in 2011. As Figure 5.7 shows, the fishing industry employed most people, around 4,600, followed by fish process-

ing with nearly 3,900 employees. We find the smallest number of employees in the new marine industries. Between 2005 and 2011 the total number of employees in fisheries and fish processing fell sharply in some instances (by 1,220 and 32 respectively), while the number of people employed in aquaculture went up (768).

Employment in the Lofoton and Vesterålen areas accounts for the largest proportion, both overall and in fisheries and fish processing in particular. Employment in the marine industries is otherwise relatively evenly distributed between areas, apart from Ofoten and Indre Finnmark, which have low employment in the industries in question.

The industries in the value chain are characterised by having a large element of seasonal work and foreign labour. Foreign labour accounts for around 20% of employees in the seafood industry (fisheries, aquaculture and fish processing) in Northern Norway. The largest element is made of immigrant workers from the new EU Member States in Eastern Europe and the Nordic Region. However, there is considerable variation between the different branches of the seafood industry with regard to the use of foreign labour. In fisheries and aquaculture around 8% of employees were foreign in 2011, while the proportion in fish processing was around 40%. Many of the jobs in the fish processing industry are seasonal, which means that the statistics may depend on what time of year they were collected.

5.3 Tourism

5.3.1 Description of the tourism industry

The tourism industry is made up of many small enterprises of several different types: hotels, restaurants, transport firms, ski lifts, experience facilities and shops. Tourism customers demand package products that include accommodation, board, transport and experiences, for example. This means that the various enterprises supply products that complement each other. The value of a flight to Lofoten depends on what is available locally, and customers' willingness to pay for a hotel bed depends on whether there are good restau-

rants, experiences and footpaths. The value of individual tourism products is even more dependent on non-commercial natural and cultural assets in the area.

The sectoral analysis for tourism focuses on two groups of tourism customers: holiday/leisure tourists and course/conference tourists (Enger et al., 2013a). The industry is also broken down into enterprises that provide accommodation, catering, transport and experience services, regardless of whether the customers are on a trip or not.¹⁰

Unless specified otherwise, the discussion of the tourism industry is based on Enger et al. (2013a).

Accommodation

Northern Norway has approaching 150 hotels with more than 20 beds, nearly half of them in Nordland, with Troms and Finnmark accounting for nearly a quarter each. As with the rest of the country, visitor traffic is much greater in the towns than outside. Larger towns and local centres attract guests all year round owing to conferences, people passing through, relatively easy accessibility for weekend trips and business travel.

Between 2007 and 2011 there was not inconsiderable growth in the number of visitor nights at Northern Norway's hotels from 1.8 million to nearly 2.1 million, equivalent to 14%. Alta experienced the highest growth with nearly 40%. The capacity utilisation rate is similar to that in the rest of the country, with Northern Norway's counties, not including Bodø and Tromsø, having a similar utilisation rate to Fjord Norway, not including the large towns (approx. 45%), while the utilisation rate in Bodø and Tromsø is roughly as high as in other large towns (65-70%).

¹⁰ Tourism is not a separate industry in official statistics, so defining the industry is not without its difficulties. Enger et al. (2013a) proceeds from a product perspective. This means, for example, that shops are not included, as the proportion of customers made up by travellers varies between areas and destinations. Catering and transport services are also used by the local population, so Enger et al. (2013a) excludes such services that are mainly used by the local population (canteens, takeaways, local buses and taxis). The latter enterprises are included in Statistics Norway's tourism statistics, so the value creation and employment figures used here are lower than those quoted by Statistics Norway and the Norwegian Hospitality Association.

The number of visitor nights at campsites and chalet villages is roughly half the number of visitor nights in hotels, standing at 1.06 million in 2011. These visitor nights break down into 61% in Nordland, 22% in Troms and 16% in Finnmark.

Transport and travel pattern

With large distances both to important markets and within the region, air travel is an important means of transport for tourists. A significant proportion of flights are between destinations in Northern Norway, but also to other Norwegian destinations, such as Oslo, Bergen, Trondheim, Rørvik and Namsos. Oslo Airport, and to some extent Bergen and Trondheim airports, are important gateways for tourism to Northern Norway. Much of the foreign traffic from Northern Norway is in the form of charter flights to southern climes, which is where the flow of tourists from Northern Norway mainly goes. There are, however, flights to Russia in particular (Kola Peninsula) that may become of central importance in bringing in tourists, but are currently used mainly by business travellers. Tromsø Airport has flights to the Nordic markets as represented by Helsinki, Luleå, Stockholm and Aalborg. Routes have also been opened to Tokyo and Moscow from Lakselv Airport, Banak, for example.

Shipping is also a key approach route for incoming travellers, in addition to which cruises are an important form of accommodation for tourists in Northern Norway.¹¹ In 2011 Northern Norway had 247,000 cruise passengers, accounting for 12% of all cruise passengers in Norway. A large proportion of these tourists (110,000) visited Finnmark. Hurtigruten is an important player in the region, and in 2011 Northern Norway accounted for around 61.7% of Hurtigruten's passenger traffic, equivalent to about 555,000 passengers.

Tours dominate the travel pattern in the summer, but with a slightly downward trend. Car tourism, Hurtigruten and cruises make up the volume. In winter, centre-based holidays dominate, but tours with

¹¹ The revenue from cruise tourism largely benefits foreign companies and only generates a limited amount of income for Northern Norway's tourism industry.

Hurtigruten and cruises are on the increase in this season. Northern lights tourism is an example of growing base tourism in the winter months.

Experiences

Although the experience segment also has local customers, experience enterprises are important for attracting tourists, and tourists are a key customer group for these enterprises. In order to illustrate the development and use of experiences, Enger et al. (2013a) presents statistics for registration-based tourist attractions, e.g. museums and swimming pools. The experience industry also includes many other types of activity, including angling, whale safaris, climbing and skiing, but there are no statistics showing their scope.

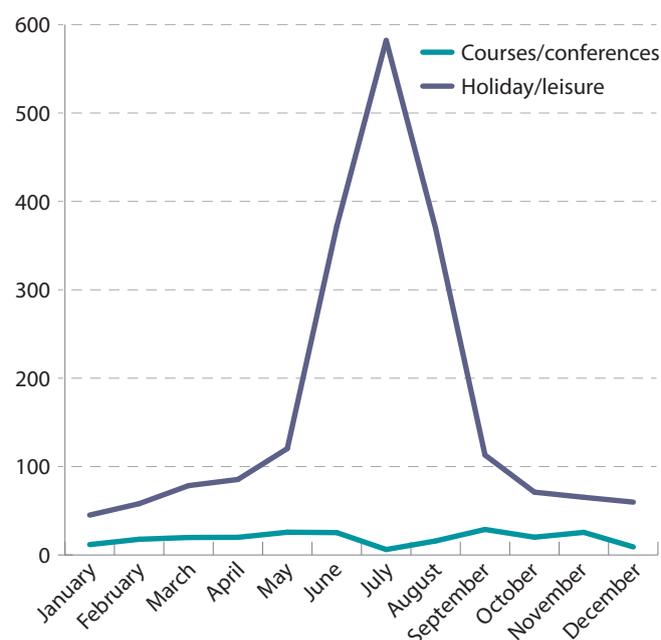
The number of museum visits in Nordland has skyrocketed since 2005. Of the large museums, the Lofotr Viking Museum in Vestvågøy saw a marked increase in visitor numbers in the period 2005-2011. In Troms visitor numbers rose considerably from 2008 to 2009 and from 2010 to 2011, but were otherwise stable. The county's largest museum, Polaria, has had relatively stable visitor numbers since 2005, while Tromsø Museum and the Polar Museum in Tromsø both experienced significant increases. In Finnmark visitor numbers remained relatively stable throughout the period.

Development for Northern Norway's largest registration-based tourist attractions was relatively stable, with increases at individual attractions. Northern Norway's biggest attraction is Nordkapp. With the exception of 2009, the year of the financial crisis, Nordkapphallen has seen visitor growth every year since 2007. Several of the most popular attractions are swimming pools, the largest of which is the Grottebadet water park in Harstad.

Sami attractions are an important contribution to value creation in tourism in Sami areas¹², and special mention can be made of the Árran Lule Sami Centre (Tysfjord) and the Riddo Duottar Museum (Karasjok)

¹² The STN area (covered by the Sami Parliament's Subsidy Schemes for Business Development) as defined in Angell et al. (2014), see also Appendix 5.

FIGURE 5.8
Bed nights for hotels, youth hostels, chalets and camp-sites in Northern Norway, by month and purpose, 2011.



Source: Statistics Norway/Menon

(Angell et al., 2014). Among other things, these attractions contribute to the Sami areas having a higher proportion of tourism employees in the experience segment than the rest of Northern Norway.

Seasonal structure

As in the rest of the country, tourism in Northern Norway is subject to considerable seasonal variation, with activity being highest in the summer. Holiday and leisure travellers contribute to this variation, while courses and conferences are more stable all year round. The latter account for a small proportion of the market, however, see also Figure 5.8. The seasonal variation is also greater for foreign travellers than Norwegians.

On average, Northern Norway had 77,200 overnight stays at hotels, chalets and campsites for holiday/leisure purposes in the winter months of 2011. This represents just 30% of the average for the summer months, which was 261,000 overnight stays.¹³

Nordland, closely followed by Finnmark, has the highest seasonal variation. There has been some evening out of the seasons in Troms and Nordland, which contributes to more tourism enterprises being able to operate all year round. The towns of Tromsø and Bodø have the lowest seasonal variation in Northern Norway.

Where do we find tourism enterprises?

The transport segment contributed roughly two thirds of value creation by tourism in Nordland in 2011. Several of Northern Norway's largest transport companies (e.g. Widerøe and Torghatten) have their head office in Nordland, and three of the transport companies accounted for 70% of value creation in the

¹³ Menon assumed that 95% of commercial visitor nights at campsites and in chalets were for holiday/leisure purposes. The remaining 5% is assumed to be made up of 2.5% for courses/conferences and 2.5% for business, with these visitor nights being evenly distributed throughout the year.

segment in 2011. The accommodation segment, which is the second largest tourism segment in terms of value creation in the county, is not dominated by large players to the same extent as the transport segment, which is confirmed by the 10 largest accommodation enterprises accounting for just over 40% of value creation in the segment in the county in 2011.

The three largest transport companies in Troms, Torghatten Nord, Cominor and Widerøe's Tromsø branch, accounted for more than 75% of the transport segment's value creation in the county in 2011. The second largest tourism segment in Troms is catering. A total of 17 of the 20 largest catering enterprises in Troms are based in Tromsø, with the other three being located in Harstad. The catering segment consists of a large number of small companies, and in 2011 the 20 largest companies accounted for 54% of value creation in catering in the county.

In Finnmark, Boreal Transport Nord and Widerøe's county offices account for the majority of value creation in the county, and more than 90% of value

TABLE 5.4
Overall key figures for the tourism industry in Northern Norway, 2011.

INDUSTRIES	NUMBER OF EMPLOYEES	TURNOVER NOK millions	PAYROLL COSTS, NOK millions	VALUE CREATION, NOK millions	VALUE CREATION PER EMPLOYEE NOK '000
Accommodation	2,645	2,508	858	1,051	397
Transport	5,049	8,275	2,720	3,640	721
Catering	2,827	1,845	645	789	279
Experiences	994	1,090	370	460	463
Agency services	387	724	184	248	641
TOTAL Northern Norway	11,901	14,443	4,777	6,188	520

Source: Menon

creation in the transport segment. As far as accommodation is concerned, the Rica Hotels chain makes the largest contribution to value creation. The group's hotels in places like Nordkapp, Alta, Hammerfest, Kirkenes, Vadsø and Karasjok accounted for 49% of value creation in the accommodation segment in Finnmark in 2011.

Ownership in tourism

Tourism in Northern Norway is characterised by a fragmented ownership structure with few large players to a greater extent than other local tourism. There are no individual enterprises in the region that are owned by hotel chains or external investor environments. Nor, with a single exception, are there any enterprises that have a franchise agreement with hotel chains. This means in principle that all the hotels linked to a chain are also owned by that hotel chain, and, conversely, that the hotel chains have not invested in related activities such as experience enterprises. Grünfelt et al. (2014) states that around 40% of the tourism industry's total capital is owned by players in Northern Norway.

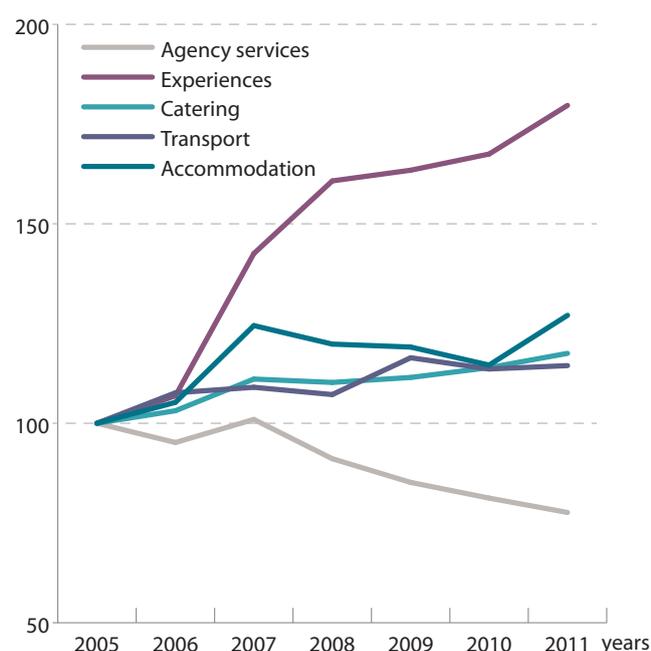
The fragmented ownership and industrial structures mean, among other things, that enterprises have limited resources for investment, product development and market development.

5.3.2 Economic key figures for tourism

The tourism industry in Northern Norway had turnover of NOK 14.4 billion and value creation of NOK 6.2 billion in 2011, see Table 5.4. In the same year, the tourism industry in Norway had turnover of NOK 133 billion and value creation of NOK 53 billion. In other words, tourism in Northern Norway accounts for 12% of all tourism-related value creation in Norway. Growth in tourism in Northern Norway was 19% between 2005 and 2011. This is somewhat lower than for the country as a whole, where growth was 27%.

Transport is by far the biggest tourism segment in Northern Norway, accounting for 56% of turnover in 2011. Accommodation accounted for 18%, followed by catering (13%), experiences (8%) and agency

FIGURE 5.9
Development in value creation for the tourism sectors 2005-2011. Indexed growth, 2005=100



Source: Menon

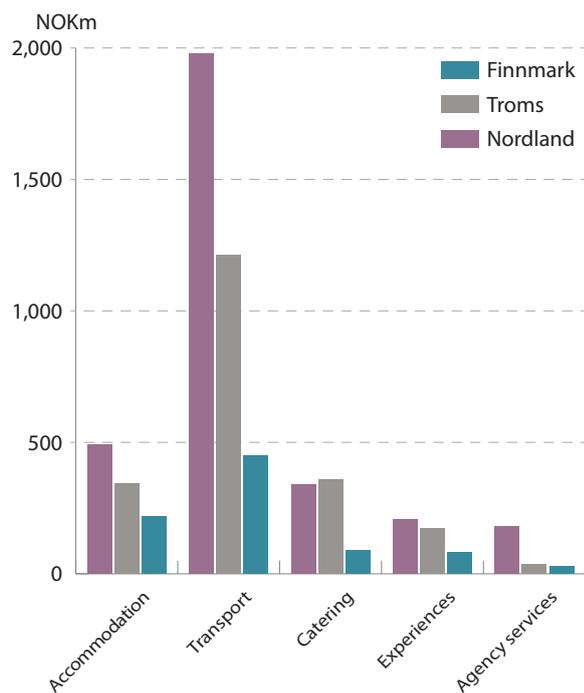
services (5%). Value creation is divided between the industries in similar proportions.

The tourism industry in Nordland had value creation of NOK 3.2 billion in 2011, while Troms had NOK 2.1 billion and Finnmark 0.87 billion. Value creation in Nordland, Troms and Finnmark has increased by 3%, 35% and 66% respectively since 2005.

How much value creation is there in the individual tourism segments?

Figure 5.10 shows value creation in the tourism industry by segment and county. The overwhelming importance of the transport segment in the region is quite apparent. The transport segment had value creation of NOK 3.6 billion and employed 5,049 people

FIGURE 5.10
Value creation in tourism by county and sector in 2011



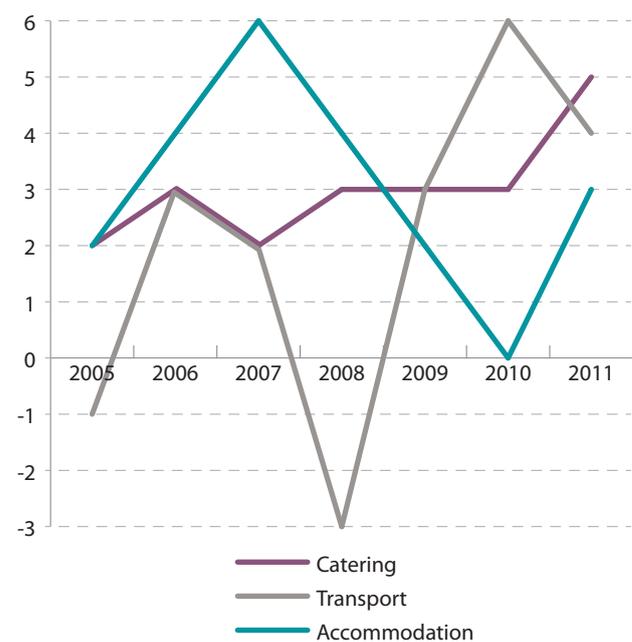
Source: Menon

in Northern Norway in 2011, in other words nearly half of all employees in the tourism industry.

Nordland saw strongest growth in the experience segment, where value creation increased by 75% between 2005 and 2011. The accommodation industry also enjoyed good growth, chalking up 33% in the same period. The relatively low growth in total value creation of just 3% is largely due to the fact that the transport segment saw a 7% decline in value creation.

Growth was strongest in the experience segment in Troms too, with value creation being 75% higher in 2011 than in 2005. The transport segment saw 40% growth in value creation between 2005 and 2011, while catering and accommodation had upwards of

FIGURE 5.11
Development in operating margin by tourism sector in Northern Norway, 2005-2011



Source: Menon

27% growth in value creation. Agency services, on the other hand, declined 45% in the same period.

Unlike in Nordland and Troms, Finnmark's largest growth in value creation was in the transport segment, with an increase of 167% between 2005 and 2011. Experiences saw good growth too, with 101% in the period. Otherwise value creation in accommodation increased by 15%, while the catering segment saw 6% growth. Value creation fell by 22% in agency services.

How profitable is tourism?

The profitability of the tourism industry in Northern Norway is extremely variable over time, see Figure 5.11. Apart from the fact that all the segments apart from transport had better profitability in 2011 than

2010, it is not possible to identify any common pattern to the variations.

Profitability varies most between segments in Troms, where the difference in operating margin between the most profitable segment (transport) and the least profitable (experiences) was around 5 percentage points in the period 2008-2011. In Nordland and Finnmark the operating margins do not vary as much between the segments. In the period 2008-2011 profitability in the various segments varied between 1.8 and 3.2% in Nordland, and between 1.6 and 3.4% in Finnmark.

Looking at value creation per employee, the picture differs somewhat from operating margin in that it was highest in the transport segment (NOK 721,000) and lowest in catering (NOK 279,000) in 2011.¹⁴ On average, payroll costs account for 77.5% of value creation, with small variations for each segment.

How many people and who does the tourism industry employ?

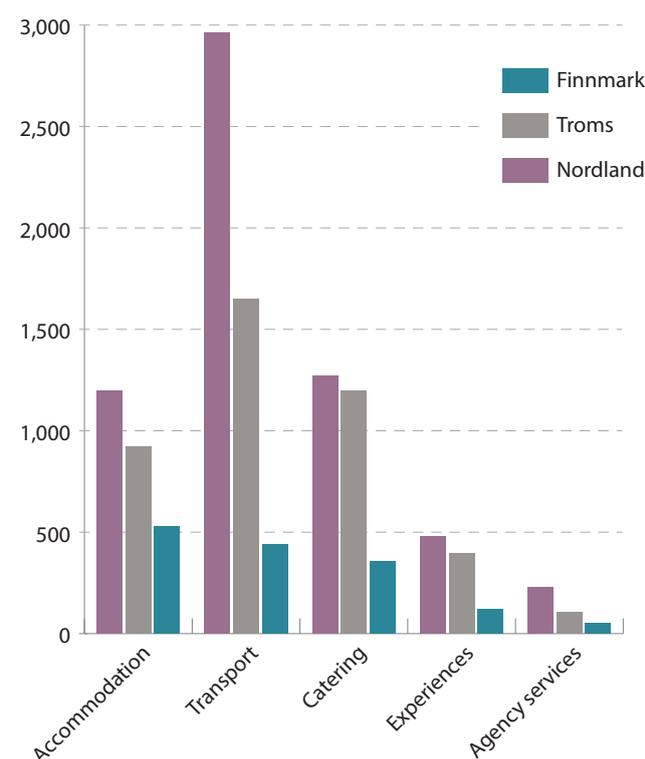
There were 11,901 people employed in tourism in Northern Norway in 2011, as against 14,080 in 2005. The 14.5% decline is explained first and foremost by efficiency improvements in the industry. As Table 5.4 shows, there were most employees in the transport segment, followed by catering, accommodation, experiences and, bringing up the rear, agency services.

In the experience and accommodation segments employment increased by 38% and 7% respectively between 2005 and 2011, while catering, transport and agency services saw a decline in employment of 13%, 30% and 13% respectively in the same period. In 2011, employment in tourism as a whole was around the 2009 level with close to the status quo in accommodation and transport, and some decline in the other segments.

As Figure 5.12 shows, Nordland has by far the most employees in the tourism industry (6,137), followed by Troms (4,272) and Finnmark (1,493).

¹⁴ In 2011, value creation per employee was NOK 641,000 in agency services, NOK 463,000 in experiences and NOK 397,000 in accommodation.

FIGURE 5.12
Employment by county and tourism sector in 2011



Source: Menon

A total of 75% of enterprises have year-round employees, with the largest number in the accommodation segment and fewest in the experience segment. The use of seasonal employees naturally follows the seasonal fluctuations in tourism in Northern Norway in general, with the largest number by far being taken on in June, July and August. A total of 73% of enterprises have seasonal employees, with the largest number in the accommodation segment (10.4 people per enterprise).

The high proportion of seasonal jobs, combined with cost competition, makes it attractive to employ foreign labour. Figures from Statistics Norway show that 3% of the employees in accommodation and catering are resident abroad. The proportion is highly variable,

however, ranging from 12% in Indre Finnmark to zero in Nord-Troms. Nordland and Finnmark have more foreign employees than Troms relatively speaking.

Enger et al. (2013a) finds that 40% of enterprises have at least one foreign year-round employee, while 55% have at least one foreign seasonal employee. Of the enterprises with foreign employees, the mean proportion of foreigners among year-round employees is 39%. The foreign employees come from 38 different nations, the majority from Russia and Sweden. The experience segment has the highest proportion of foreign employees with 43% on a year-round basis, while 53% of seasonal employees are foreign. Catering has the lowest proportion with 31%. The agency services segment has the highest proportion of foreign seasonal employees with 86%.

5.4 Renewable energy

5.4.1 Description of the renewable energy industry

The renewable energy sector is a big contributor to society in the form of both local government taxes and dividend payments. The companies in this sector are a very important source of revenue for the municipalities in Northern Norway, but also an important contributor to a number of good social causes. Many of the smaller municipalities in Northern Norway are reliant on the revenue contributed by the sector.

Renewable energy includes electricity, heat production and potential fuel production. In the knowledge-gathering project we divided this industrial sector into the following segments: hydropower, wind power (land-based and offshore), tidal and wave power, solar energy, thermal energy (various forms of bioenergy), electric power transmission and energy sales. The focus is on hydropower, which is the dominant energy source today, and wind power, which offers the greatest future potential. Unless specified otherwise, the description of the industry is based on Analyse & Strategi et al. (2013).

Hydropower

Nordland is one of the country's largest electricity producers, and two of Norway's 10 largest power

plants are located in Nordland, Rana Hydroelectric Power Station and Svartisen Hydroelectric Power Station. The largest producers of hydropower in Nordland are SKS Produksjon, Nordkraft Produksjon, Helgelandskraft, SISO Energi, Easter Norge Svartisen, Nord-Salten Kraft and Trollfjord Kraft.

In Troms there are three big players in hydropower production, Troms Kraft Produksjon, Hålogaland Kraft and Ymber. Troms Kraft is the largest power group in Northern Norway.

In Finnmark there are seven companies producing electricity from hydropower (Alta Kraftlag, Hammerfest Energi, Luostejok Kraftlag, Nordkyn Kraftlag, Pasvik Kraft, Porsa Kraftlag and Repvåg Kraftlag).

Statkraft is full or part owner of 13 hydropower plants in Nordland, and two power plants in Troms and Finnmark respectively.

Wind power

In Nordland a total of five players have been granted a licence by the Norwegian Water Resources and Energy Directorate (NVE) to operate wind farms, but just one, Nordkraft Vind at Nygårdsfjellet, is currently operating commercially. Other places where licences have been granted include Ånstadblåheia Wind Farm in the Municipality of Sortland and Andmyran Wind Farm at Ramså/Breivik on Andøya.

In Troms two players have been licensed by NVE to operate wind farms. One is Norsk Miljøkraft FOU AS, which is conducting research into wind power in Northern Norway's wind and weather conditions. The other is Troms Kraft Produksjon's Fakken Wind Farm in the Municipality of Karlsøy, which has been in production since 2012.

The coastal areas of Finnmark are among the most suitable areas for wind power in a European context. There are currently two wind farms in commercial operation in Finnmark, one in Havøysund and one in Kjøllefjord. Licences have also been granted to Dønnes-

fjord Wind Farm in the Municipality of Hasvik, Fálesrášša Wind Farm in the Municipality of Kvalsund, Hamnefjell Wind Farm in the Municipality of Båtsfjord and Rákkočearro Wind Farm in the Municipality of Berlevåg.

NVE is considering a number of licence applications in all three counties.

Offshore wind

As yet there are no offshore wind farms in operation in Northern Norway, but several players have applied for a licence. One example is Troms Kraft, which has applied for a licence for Vannøya Offshore Wind Farm consisting of about 250 fixed-bottom wind turbines. Another example is Nordnorsk Havkraft, a joint venture between several players in Nordland and Troms aimed at the development of offshore renewable energy projects, including both bottom-fixed and floating offshore wind power.

Solar energy

Solar energy and related industry experienced very strong growth in Nordland between 2003 and 2012, driven by Renewable Energy Company (REC) with factories in Glomfjord and Narvik. The company had secured various exclusive rights relating to technology for producing silicon and wafers. In 2012 both the factories were closed down as a result of low demand and high prices on the market. Another Narvik-based company, Norske Innotech Solar, has developed a process for identifying and correcting defects in solar cells. This company still exists, but has reduced its workforce.

Tidal and wave power

As yet, tidal and wave power are very immature technologies. Andritz Hydro Hammerfest installed the world's first tidal turbine, which generated electricity from the kinetic energy in the tide and supplied it to the commercial grid, in Kvalsundet in 2003. In Harstad, Straum Hydra Tidal has developed a full-scale prototype, MORILD, which has been tested and demonstrated in Gimsøystraumen in Lofoten, but is out of operation for the time being owing to a breakdown.

District heating

District-heating plants have been developed in a number of towns in Nordland. The largest plant is in Mo i Rana and uses surplus energy from process enterprises in Mo Industripark. Other places with district heating include Sandnessjøen, Bodø, Sortland and Myre. Licences have also been granted in the Municipality of Vefsn and Narvik.

In Troms district heating has so far been established in Tromsø and Harstad, and a licence has been granted for the development of a district-heating network on Tromsøya. A district-heating licence has also been applied for in Finnsnes with a view to exploiting energy from the waste incinerator at Botnhågen and waste heat from Finnjord AS.

In Finnmark there are four district-heating plants in operation in Karasjok, Lakselv and Alta (two plants). In addition, Varanger Kraft has been working for several years to establish an energy recycling plant with district-heating network in the centre of Kirkenes.

Transmission

There are a large number of players in Nordland with a licence to distribute electricity, the largest of whom are Helgelandskraft and Nordlandsnett. In Troms there are only three companies that distribute electricity via the local and regional grids, while Finnmark has seven companies doing the same. Statnett's regional centre for Northern Norway is in Alta (Vest-Finnmark), but with several branches elsewhere in the region.

In addition to the usual power players, there are also some industrial enterprises that distribute electricity to their divisions/customers, one example being Mo Industripark, which distributes electricity to the shipyards based in the industrial park.

Power sales

Ishavskraft is the largest power sales company in Northern Norway and one of the largest in the whole country. It has its head office in Alta and a branch in Tromsø. Other companies engaged in power sales in Finnmark

include Varanger Kraft in Øst-Finnmark and Hammerfest Energi Kraftomsetning. In South Troms, Hålogaland Kraft sells power to end-customers. There are several power sales companies in Nordland, the largest being SKS Kraftsalg, which has an office in Fauske.

Social engagement and sponsorship

Many power companies are concerned about their social responsibility, and the largest power groups prepare social accounts reporting on how they contribute to society. The companies' annual reports for 2011 show that support was given to local sports clubs, arts centres, cultural events, music festivals, research, sporting activities, and work with children and young people.

Ownership in renewable energy

Ownership in this sector is complex. A large number of the power companies have stakes in each other's companies. There is also some level of public ownership in most of the companies.

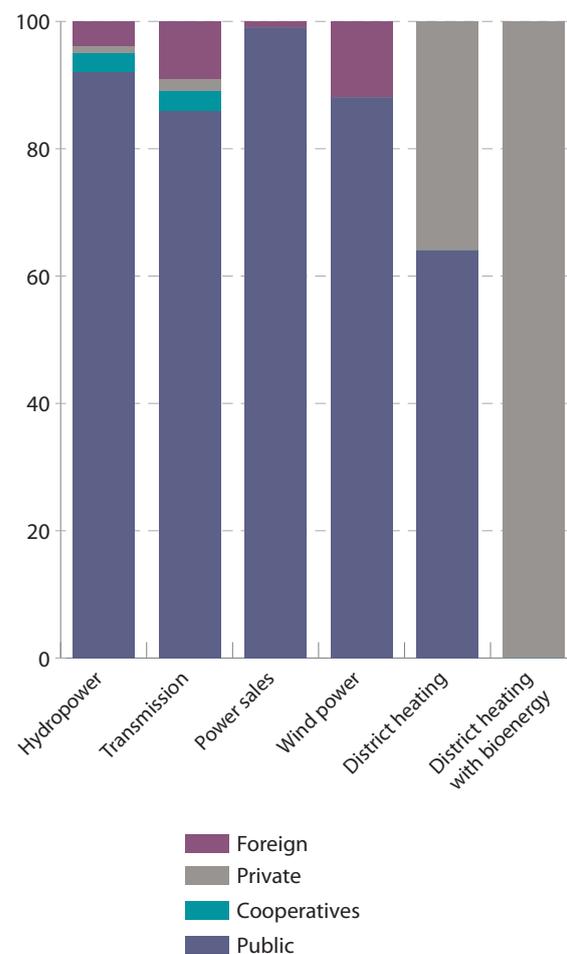
The companies that produce, distribute and sell hydropower are all largely in public ownership, but some also have private owners through cooperative societies. A number of years ago there were a lot more cooperatives where the local population owned the power companies in their own municipality.

Traditionally, there has been very little international ownership in the sector. There is international ownership of several wind power companies, however. One example is Andmyran Vindkraft, which is owned by the Swedish Wallenstam. For the time being the wind power segment is characterised by not having many players with turnover.

The district-heating companies are largely owned by the region's power companies, but with some private companies involved. Mo Fjernvarme is one example of this, with Mo Industripark owning 60% of the company, while Helgelandskraft owns the remaining 40%.

The size of ownership can be illustrated in different ways, and Figure 5.13 shows ownership as a propor-

FIGURE 5.13
Ownership based on largest owner as a proportion of turnover in the renewable energy industry.



Source: KPB

tion of turnover in the companies for the four ownership categories. It is clear from this that there is a high level of public ownership in the sector.

5.4.2 Economic key figures for renewable energy

The renewable energy sector employs around 2,700 people and had turnover of nearly NOK 17 billion in 2011, see Table 5.5. As well as being a key employer in rural areas, the sector has been very

TABLE 5.5
Overall key figures for renewable energy in Northern Norway, 2011.

INDUSTRIES	NUMBER OF EMPLOYEES	NUMBER OF ENTERPRISES	TURNOVER NOK millions	PAYROLL COSTS, NOK millions	VALUE CREATION, NOK millions	VALUE CREATION PER EMPLOYEE NOK '000
Hydropower	973		7,148		4,352	4,473
Wind power	3		62		12	4,000
Other renewable energy	621		3,268		- 39	- 63
Thermal	28		108		32	1,143
Transmission	1,001		3,441		1,447	1,446
Power sales	98		2,866		197	2,010
TOTAL Northern Norway	2,724	193	16,893	1,673	6,000	2,203

Source: Analyse & Strategi, KPB

important in the development of industry in the region. A large proportion of the power has been used for industrial production, with both local and imported raw materials being processed.

How much value creation is there in renewable energy?

In 2011, 71% of total value creation in renewable energy came from companies generating hydroelectricity, while 24% was from companies that distribute electricity. Just over 3% of value creation is accounted for by power sales companies. The district-heating companies in Northern Norway had value creation of NOK 32.2 million in 2011. As far as hydropower, transmission and power sales companies are concerned, value creation is highest in Nordland by some margin, see Figure 5.14. Value creation in wind power is somewhat higher in Finnmark than in Nordland, while value creation in district heating is highest in Troms.

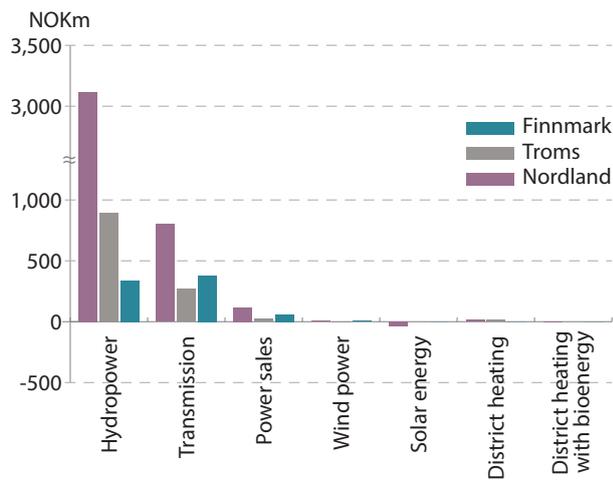
Figure 5.15 shows how value creation developed between 2004 and 2011.¹⁵ At around NOK 6 billion, value creation in 2011 is slightly more than double the 2004 figure. Some of the changes from year to year are due to fluctuations in prices and production (which is dependent on rainfall).

How profitable is renewable energy?

Profitability, measured as return on investment, was 10.7% for the renewable energy sector as a whole in 2011, i.e. profitability was good. Owing to large fluctuations in both power production and prices, there are substantial differences in profitability from year to year, see also Figure 5.16. In 2008 and 2010 the sector showed good profitability overall, with a return on investment in excess of 15%.

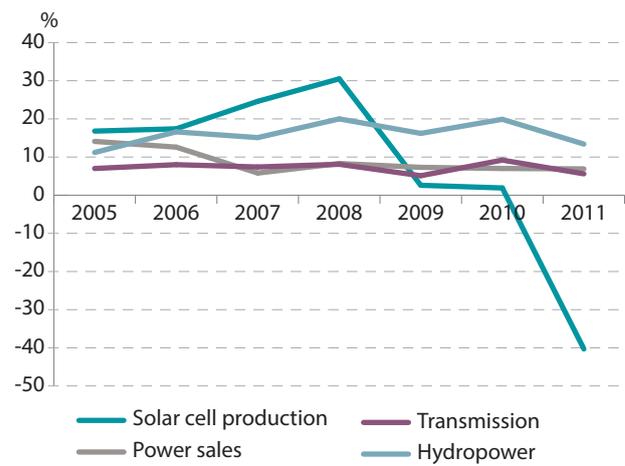
¹⁵ In Analyse & Strategi et al. (2013) growth is presented in nominal prices (current prices). In the final reports growth is expressed in real prices, with the nominal prices being deflated using the consumer price index.

FIGURE 5.14
Value creation by sector and county for renewable energy, 2011



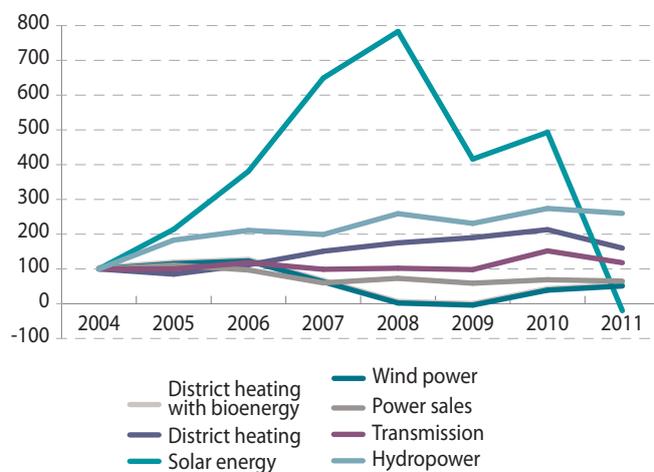
Source: KPB/ENIRO

FIGURE 5.16
Profitability in renewable energy by sector 2005-2011, mean return on investment



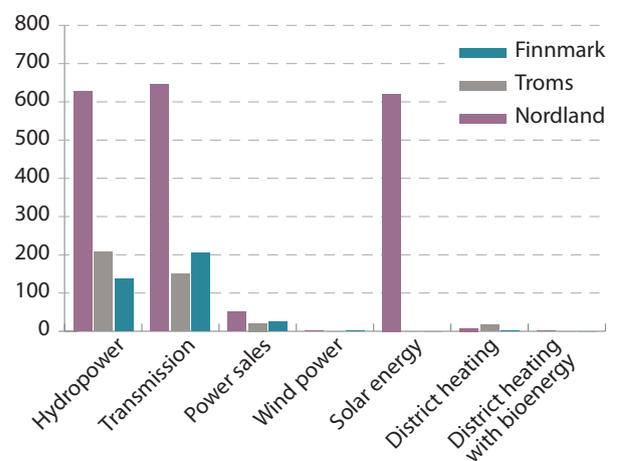
Source: KPB/ENIRO

FIGURE 5.15
Development in value creation for renewable energy 2004-2011, indexed growth, 2004=100



Source: KPB/ENIRO

FIGURE 5.17
Number of employees in renewable energy by sector and county, 2011



Source: KPB/ENIRO

It is the companies generating hydropower that have the highest profitability. In five out of the last seven years the profitability of these companies has been between 15 and 20%. The profitability of companies distributing electricity has averaged 7.2% in the last seven years.

How many people and who does renewable energy employ?

Virtually everyone working in renewable energy in Northern Norway is employed in a company that produces, distributes or sells hydropower, see Figure 5.17. Nearly everyone who worked in the solar energy segment lost their job when REC closed.

In 2011 there were 371 employees in the sector in Finnmark and 398 in Troms. Nordland has the most employees in renewable energy, with just over 70% (1,955 people) of employment in Northern Norway. As a result of the REC closure, the corresponding employment figure for 2012 is just over 60%.

Despite the fact that several companies are registered in the wind power segment, only three employees are registered in Northern Norway. The wind power companies rely on contract labour, either from internal suppliers (parent or sister companies) or from subcontractors. There are 27 people registered as working in district-heating companies in Northern Norway. Nine of them are employed by Troms Kraft Varme AS and nine by Senja Avfall. Only one employee is registered for Northern Norway's bioenergy companies. As with wind power, several companies contract the labour they need from internal or external suppliers.

The annual reports for the power companies show that this is a male-dominated sector with a low proportion of female employees. The female employees mainly work in administrative functions and property management. In many companies the workforce has a high average age, and a large proportion will be retiring over a five-year period.

There is very little use of seasonal workers in this sector. Seasonal workers for line clearing, for example, are usually hired through subcontractors.

Foreign labour is virtually non-existent in the power companies in Northern Norway. This may be because the companies mainly recruit locally, security is given a high priority and employees have to be fluent in Norwegian. In addition, many of the plants are secure installations with clear restrictions on who can work there.

5.5 The mineral industry

5.5.1 Description of the mineral industry

Northern Norway is a key region for the Norwegian mineral industry. This industry includes the extraction and production of metal ores, industrial minerals, natural stone and building materials. The knowledge-gathering project essentially concentrated on ores and industrial minerals, as natural stone and building materials are of little importance in terms of value creation in Northern Norway. Unless specified otherwise, the discussion of the mineral industry is based on Vista Analyse and Sweco (2013).

Metal ores

Ore production is capital intensive and large scale, and often involves major intervention in nature. There are frequently conflicts with other stakeholders in the area and licences are granted on a case-by-case basis following comprehensive consequence analyses. Ore production provides opportunities for developing smelting operations locally, particularly in combination with local energy resources. In total, 88% of production was exported in 2011 (NGU, 2012). With short sailing times to European smelting plants, Norwegian ore production has a competitive advantage over producers in Brazil and Australia.

Metal prices have varied considerably over time, see Figure 5.18. The fall in the price of copper in connection with the financial unrest in 2008 shows this to be an economically sensitive market where considerable price variations can be expected in the future too.

FIGURE 5.18
Price development for iron (left) and copper (right), 2004-2014. USD/dry metric ton.



Source: Index mundi

Industrial minerals

Industrial mineral production is also capital intensive, but generally involves production and intervention on a smaller scale than ore production. This segment includes production of many raw materials and generally consists of more and smaller units than the ore segment. The industrial mineral segment is also export oriented, and Norway is a world leader in some niches. In the case of a number of industrial minerals access is now regarded as critical and/or of strategic importance, so Norway's industrial mineral resources are therefore strategically important too.

The industrial mineral market is closely linked to the industries that benefit from the minerals, and demand is dependent on development in those industries. The majority of Norway's industrial minerals are exported, primarily to industry in Europe. The industry that uses specific industrial minerals is generally dependent on a predictable, secure supply, so contracts for the supply of industrial minerals are usually long term, lasting up to 10 years. This enables the supplier to invest in the necessary plant and processes to ensure that the raw material is of the desired quality. Long-term contracts shelter the segment from the fluctuations characteristic of a more open market.

Natural stone

Natural stone (primarily block stone and slate) represents the smallest part of the industry in terms of turnover, and the number of full-time equivalents in the segment has fallen in the last decade. In Nordland there is granite and marble production, for example.

Production of slate and masonry stone is mainly targeted at a national market, and hard-wearing Norwegian quartz slate, which is quarried in Alta, for example, is regarded as especially suitable for highly trafficked areas. Around 20% of Norwegian slate production was exported in 2011 (NGU 2012).

Building materials

The building material segment has grown rapidly in the last decade in terms of both turnover and number of full-time equivalents. The segment is characterised by a large number of small producers and relatively high flexibility with regard to production location. The product has a low unit value, so the segment operates with large volumes, which in turn makes transport costs important, so the market is relatively local or regional.

TABLE 5.6
Sales value in 2011, in total and by selected counties and raw material types. NOK '000

	NORWAY	FINNMARK	TROMS	NORDLAND	TOTAL NORTHERN NORWAY
Ores	2,462,860	1,163,094	-	645,823	1,808,917
Industrial minerals	2,932,418	396,697	33,840	487,124	917,661
Natural stone	921,612	75,201	756	1,957	77,914
Building materials	4,672,753	73,145	88,629	219,727	381,501
Total	10,989,643	1,708,137	123,225	1,354,631	3,185,993

Source: NGU (2012), Vista Analyse.

Value chains

The value chains in the mineral industry include players who carry out surveying and prospecting, mineral companies, processing companies (including smelting works/metallurgical companies), machine, component and merchandise suppliers, service providers, and logistics and transport suppliers. Internationally, there are opportunities for exporting Norwegian technology and competence, as well as for foreign investment. Norway does not have its own supplier industry for the mineral sector, unlike Sweden and Finland, which both have a well-developed supplier industry for this sector.

Where do we find the enterprises?

The mineral industry is rural, with extraction and production in places where there are frequently not many other opportunities for employment and value creation. The industry has considerable local ripple effects, with it usually being estimated that one full-time equivalent in the mineral industry gives rise to three or four full-time equivalents in other industries (NGU 2012).

Finnmark and Nordland are important areas for the production of ores and industrial minerals, while Troms does not have any ore operations and only marginal extraction of industrial minerals, see Table 5.6.

Ownership in the mineral industry

A matter of 20 years ago the state was a major owner, especially in the ore industry through ownership of Norsk Jernverk/Rana Gruber and AS Sydvaranger with subsidiaries, but today the state does not own any stakes in the mineral industry in mainland Norway. Nationally there are several large export-oriented enterprises in the industry that are wholly or partly owned by foreign companies, whereas the situation is slightly different in Northern Norway. Of the ore producers, Rana Gruber is Norwegian owned, Nussir ASA is 70% Norwegian owned and Sydvaranger Gruver is owned by an Australian company in which Norwegian players own a majority of the shares. When it comes to industrial minerals, foreign ownership is common, but here too several players in Northern Norway are Norwegian owned, including Skaland Graphite and Brønnøy Kalk.

TABLE 5.7
Overall key figures for the mineral industries in Northern Norway, 2011.

INDUSTRIES	NUMBER OF EMPLOYEES	NUMBER OF ENTERPRISES	TURNOVER NOK millions	PAYROLL COSTS, NOK millions	VALUE CREATION, NOK millions	VALUE CREATION PER EMPLOYEE NOK '000
Metal ores	813	2	1,809	348	811	997
Industrial minerals	239	6	462	91	187	784
Natural stone	53	4	33	6	10	180
Building materials	179	74	268	59	101	564
TOTAL Northern Norway	1,284	86	2,573	504	1,108	863

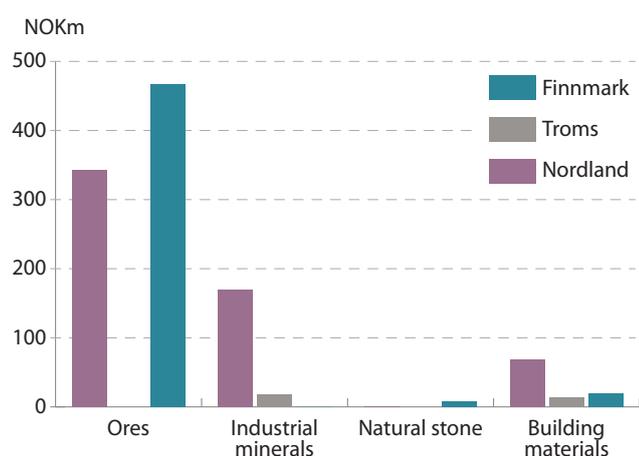
Source: Proff database, NGU, Vista Analyse

FIGURE 5.19
Value creation in the mineral industry by sector 2003-2011. Indexed growth, 2003=100.



Source: Vista Analyse

FIGURE 5.20
Value creation in the mineral industry by sector and county, 2011¹



¹ The figures are taken from Proff and do not include all enterprises, so are slightly low. Figures from NGU, for example, show that 130 people are employed in industrial minerals in Finnmark, while value creation in this sector in Finnmark is NOK 0 according to Proff.

Source: Vista Analyse

5.5.2 Economic key figures for the mineral industry

The mineral industry is capital intensive, with much higher real capital per employee than the mean for Norwegian industry. In recent years, total production value in terms of current prices has seen roughly the same development in the mining industry as in other land-based industry. Table 5.7 gives the key figures for turnover and profitability in the mineral industry in Northern Norway in 2011.

The turnover in Table 5.7 (NOK 2.6 billion) is lower than the total market value in the three northernmost counties (NOK 3.2 billion), see Table 5.6. This discrepancy is partly due to differences in industry classification in the sources used. According to Vista Analyse and Sweco (2013), the market values probably best represent the size of turnover in the mineral industry in Northern Norway.

In 2011, value creation represented 43% of turnover. This is relatively high compared with the historical mean processing value for the mining industry in Norway, which is around 35% of gross production value. Figure 5.19 shows development in value creation in the mineral industries. Building materials saw growth in value creation in the period 2003-2011, as did metal ores, particularly after 2009.

How much value creation is there in the mineral industry?

Total value creation in the mineral industry in 2011 was NOK 1.1 billion. This was made up of NOK 811 million from metal ores, NOK 190 million from industrial minerals, NOK 9.5 million from natural stone and NOK 101 million from building materials.

As far as metal ores are concerned, value creation is concentrated onsentrert in Nordland and Finnmark, see Figure 5.20. Industrial minerals and natural stone are somewhat more dispersed between all three counties in Northern Norway. There are building material operations throughout the region, with the highest value creation in Helgeland and the lowest in Indre Finnmark.

How profitable is the mineral industry?

In 2011, the mean return on investment in the mineral industry was 11.3%. In other words, profitability is very good. Industrial minerals make the main contribution to this with mean return on investment of all of 24.5%, see Figure 5.21. The return on investment for building materials is in line with the mean at 10.1%, while both metal ores and natural stone have a lower return on investment with 9.3% and 6.9% respectively. However, the return on investment for the mineral industry as a whole has varied widely since 2003, partly as a result of fluctuating prices on the world market.

Profitability in terms of value creation per employee is relatively high in metal ores and industrial minerals at nearly NOK 1 million and NOK 0.8 million respectively. In the case of metal ores in particular this reflects capital intensity more than high profitability.

FIGURE 5.21
Profitability in the mineral industry by sector, 2003-2011



Source: Vista Analyse

How many people and who does the mineral industry employ?

Ores (iron) have a significant impact on employment in Finnmark, as do industrial minerals to some extent, see Figure 5.22 (see page 102). Nordland has substantial mineral-related employment in the ore, industrial mineral and building material segments. Finnmark and Nordland account for 75% of all full-time equivalents in Norway in ore production and 39% of all full-time equivalents in industrial mineral production.

Employment in ore extraction has grown in recent years and especially strongly from 2009 to 2010, largely as a result of AS Sydvaranger commencing operations in autumn 2009. Owing to the increase in building activities in recent years (see discussion of other industry), there has been strong growth in

employment in the production of building materials (66% between 2006 and 2011), while employment in industrial minerals grew by 15% in the same period.

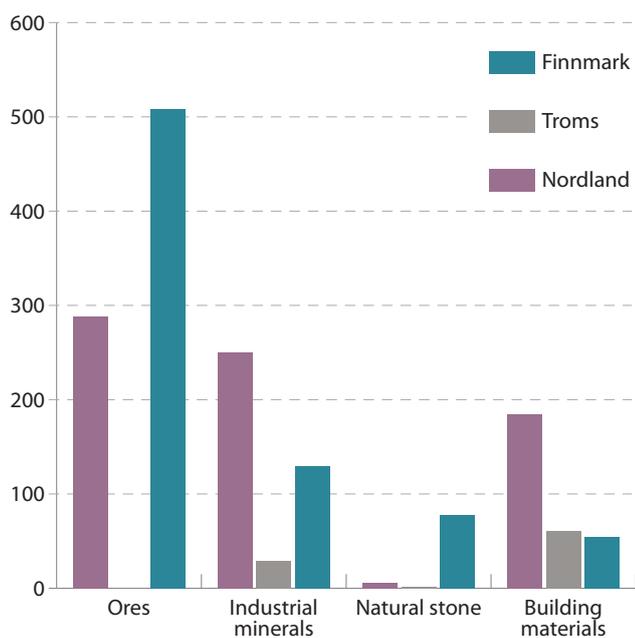
The mineral industry does not employ many immigrants, but the percentage increased from 4% in 2008 to a good 6% in 2011.

5.6 Other industry and business

5.6.1 Description of other industry and business

Other industry and business accounts for 78% of employment and 72% of value creation in business in Northern Norway if the public sector is left out of the equation. Other industry and business is made up of very different industries of varying size. The knowledge-gathering project divides these industries into eight sectors: Maritime, Oil & Gas, Industry, Trade,

FIGURE 5.22
Number of full-time equivalents in the mineral industry in 2011, by county and raw material type



Source: NGU (2012).

Building & Construction, KIBS (Knowledge-Intensive Business Services), Logistics & Transport, Finance, Culture, Miscellaneous. The first two sectors are export intensive, while the others largely consist of local service providers, with some exceptions. The markets for these two groups are very different, and they mainly compete with international and local players respectively. Unless specified otherwise, the following discussion of the industries is based on Espelien et al. (2013).

Export-oriented activities

Maritime, oil & gas is an industry made up of maritime enterprises and oil and gas suppliers. The majority of

enterprises are involved in maritime activities, but several of them are also offshore oriented.¹⁶

The maritime industries have a long tradition in Northern Norway. This is most closely associated with fisheries and the coastal transport of passengers and goods, while petroleum activity is of much more recent date. The supplier industry varies from general suppliers who are not industry specific to enterprises that supply high-tech solutions targeted at petroleum activity in the Arctic.

Maritime operations in an Arctic climate present challenges of which there is little experience further south – cold, icy waters, for example. Operators in Northern Norway already deal with such challenges, giving them a competitive advantage over companies in the south. A further location-related advantage enjoyed by the maritime industry is linked to new transport opportunities between Europe and the East through the Northeast Passage.

There are two parts to the industry sector, one of which is sensitive to economic conditions and is strongly affected by developments in the world economy. This includes metal production, production of wooden articles, chemical production and production of other industrial articles. The other segment is the food industry, which in Norway is sheltered from foreign competition to a large extent by high tariffs, with there being little national competition owing to the small number of producers.

Nordland is Northern Norway's industrial county, and towns like Mosjøen, Narvik and Mo i Rana have a long industrial tradition. Industry in Northern Norway provides important jobs, especially in some local communities, but has encountered stiff competition from abroad in recent years.

Industry has two key competitive advantages in Northern Norway, access to raw materials and cheap

¹⁶ Fishing activities linked to the maritime industry are not included in this description, as they are covered under the marine industries.

electricity. Long industrial traditions can also be regarded as a competitive advantage to some extent in that experience and knowledge have contributed to efficient production methods and operation.

Local services

Demand in building & construction, culture, transport & logistics, trade, finance and miscellaneous is linked to local demand. The driving forces for development and growth in this segment therefore have to come from growth in the local market.

Building & construction is of central importance in the Norwegian economy. Nationally, the building and construction industry accounted for 14% of value creation and 19% of employment in 2011, while the corresponding figures for Northern Norway were 17% and 21% respectively. Although the building and construction industry is concentrated on the largest urban areas, the building industry is most important in the rural areas (Espelien and Reve, 2007). The industry is very sensitive to economic conditions, as in times of economic growth people invest in renovation and new building, which are easy to put off during a downturn.

The building and construction industry is distributed throughout Northern Norway and its geographical structure largely follows the settlement pattern. The largest enterprises either carry out building and construction or produce goods for the industry. Several of these are cornerstone enterprises of great importance for total employment in the area.

Culture performs a function both as a value-creating industry and in making an area more attractive to live in. The industry differs from most other business in that parts of it receive public operating subsidies, among other things so that they can fulfil a social role. Some of the recipients are not-for-profit enterprises, which affects growth and profitability in the industry.

In many municipalities with a small number of inhabitants cultural enterprises can account for a substantial proportion of total business. This is illustrated by

the importance of the cultural industry in Indre Finnmark, for example. This area has the lowest value creation and employment, but its value creation in the cultural industry is 6.5 higher than in the rest of the country. All of 16% of total value creation and employment in the area can be linked to the cultural industry.

The cultural industries are important in the Sami areas, both as a basis for business and as a means of communicating Sami language and culture, see Angell et al. (2014). The two largest enterprises in Finnmark are Sami cultural enterprises: NRK Sápmi in Karasjok and Beivvas Sami Nasunalateahter (Sami National Theatre). In the STN area used in Angell et al. (2014), see Appendix 5, nearly 3% of employees work in the cultural industry, which is on a par with Northern Norway as a whole, but twice the figure in other rural municipalities in the north.

Trade contributes to a living community by providing access to food, medicine and other consumer goods. The industry is largely driven by settlement pattern and tourism. The industry has experienced great change since the 1960s, going from small local retailers and merchants to more national and international chains, as well as various franchise solutions. This has contributed to greater economies of scale and improved logistics solutions. From a regional perspective, Salten and Tromsø account for by far the most trade. The least trade by a considerable margin is in Indre Finnmark and Nord-Troms.

*Transport & logistics*¹⁷ is a relatively small industry in Northern Norway in terms of value creation and employment, but it is of vital importance for other industries, including the marine industries, maritime industry, offshore supplier industry, trade, and building & construction. High intensity of goods, high exports, high willingness to pay to have goods and/or input factors transported to the right place at the right time, and geographical spread are all contributory factors. The logistics industry makes transport more efficient and helps to minimise the negative impact of

¹⁷ Mainly goods transport, as passenger transport is discussed under tourism

geographical distance. The logistics and transport industry has a markedly decentralised structure in Northern Norway, where it is represented in all areas.

Northern Norway is a long way from the markets for foreign players. Being local gives the transport industry a competitive advantage. Together with unique knowledge of traffic conditions in the region, this is probably the industry's most important competitive advantage in the region.

Knowledge-intensive businesses services (KIBS) supply professional knowledge as their most important service.¹⁸ The most important input factors for knowledge-based service providers are competence and relationships. Activity in the industry is spread throughout Northern Norway. The industry is, however, concentrated to the greatest extent in larger town centres such as Tromsø, Alta, Bodø, Narvik, Mo i Rana, Sandnessjøen and Mosjøen.

Finance is an important service provider for other business in that it channels capital. The industry also contributes extensive competence with regard to investing capital and solving temporary liquidity problems for business, households and the public sector. The industry has seen major changes in the last 10 years, with digitalisation contributing to less knowledge-based services becoming more efficient and marginalised. This has led to an increased need for competence, and the proportion of people with higher education with specialist competence has increased enormously. Northern Norway has been lighter on competence than the rest of the country, however. Digitalisation has also resulted in settlement pattern no longer being a vital factor in the location of bank operations, and there is an increasing amount of centralisation and internationalisation in the finance sector. One example of this is Nordlandsbanken, which was taken over by DnB in 2002 and wound up in 2012.

¹⁸ As defined in Espelien et al. (2013), the industry does not cover knowledge-based services targeted at the industries looked at in the knowledge-gathering project, as these are discussed under the respective industries. Building consultants, for example, are discussed under the building and construction industry. This means that the industry is probably smaller in Northern Norway than nationally.

Miscellaneous industry consists of enterprises that are not covered by any of the sectoral analyses or the industry-specific descriptions for other industry and business. The industry is largely made up of service providers. Cleaning services are the largest single group, closely followed by private nurseries and aviation-related services. The industry also includes enterprises providing services to both private households and businesses, such as hairdressers and accountants, as well as enterprises other than nurseries initiated or financed by the public sector. We also find telecom suppliers and other ICT activity in telecoms and IT in this group. The industry follows the settlement pattern and general business activity in an area in its scope.

Ownership

Ownership in Northern Norway is characterised by personally owned enterprises to a greater degree than in other parts of the country, and this form of ownership is particularly prominent in trade, building & construction and the maritime industry. There is somewhat more foreign ownership in oil & gas. In trade, a not insubstantial part of the grocery sector is also owned through cooperative societies.

Knowledge-intensive services and logistics & transport have private, public and foreign ownership to a somewhat greater degree, while industry has the highest proportion of foreign ownership, particularly in the part of the industry exposed to competition, whereas more of the enterprises in the sheltered part of industry are organised in the form of cooperative societies.

The cultural industry has the highest level of public ownership in Northern Norway by virtue of NRK, several newspapers, museums and other cultural players. Private ownership in the industry is largely linked to printers and culture-related businesses.

In finance, the Sparebank 1 *foundation* is the most dominant owner by far in Northern Norway.

TABLE 5.8
Key figures for other industry and business

	NUMBER OF EMPLOYEES	NUMBER OF ENTERPRISES	TURNOVER NOK millions	PAYROLL COSTS, NOK millions	VALUE CREATION, NOK millions	VALUE CREATION PER EMPLOYEE
Trade	23,375	3,443	64,664	7,441	9,803	419
Building & construction	22,627	3,209	41,929	10,266	13,793	610
Miscellaneous	21,762	7,603	30,326	9,262	15,183	698
Maritime, oil & gas	7,869	580	15,792	4,458	5,650	718
Industry	7,854	549	25,793	3,782	5,969	760
KIBS	5,486	1,081	6,032	2,856	3,343	609
Culture	3,498	501	4,200	1,585	1,903	544
Logistics & transport	3,098	402	5,423	1,475	2,016	651
Finance	2,561				4,217	1,647
TOTAL other industry and business	98,130	17,368	194,159	41,125	61,877	631

Source: Menon

5.6.2 Key figures for other industry and business

A total of 98,000 people are employed in the other industry and business sector. Value creation from business activity is just under NOK 62 billion, see Table 5.8. In total, other industry and business accounts for 78% of employment and 72% of value creation in business in Northern Norway. In terms of employees, trade is the largest segment, while the miscellaneous category and building & construction have the highest value creation. The businesses that make up local services accounted for 83% of employment and 81% of value creation in this composite sector in 2011.

Value creation

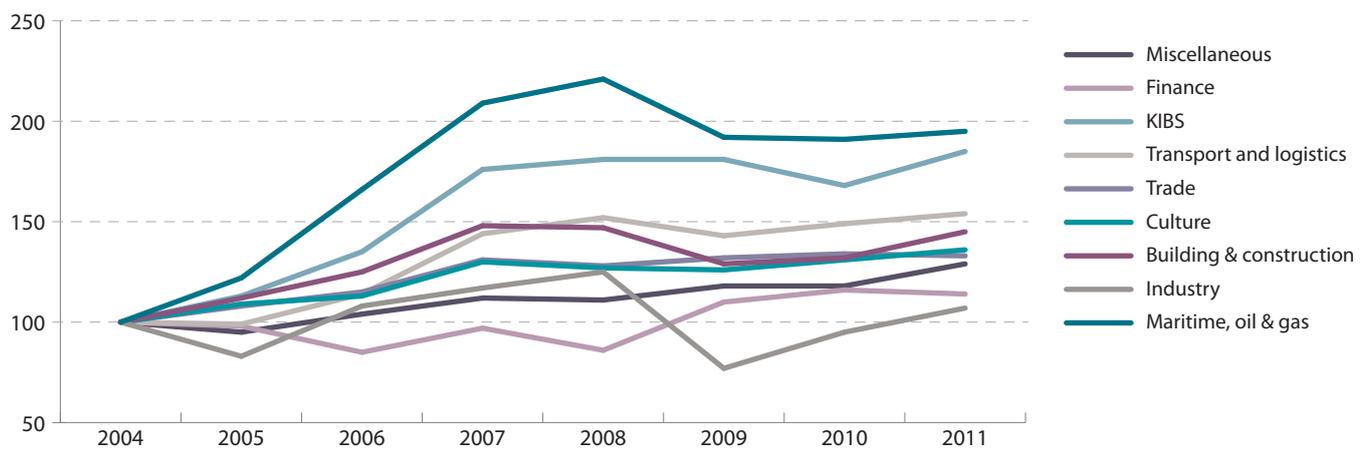
In this section we take a closer look at growth in value creation¹⁹ between 2004 and 2011 in the individual segments, and how value creation is distributed between the three counties, see also Figure 5.23 and Figure 5.24.

Value creation in maritime, oil & gas in real prices nearly doubled from 2004 to NOK 5.6 billion in 2011. Large individual companies dominate development in the region. The four largest companies²⁰ account for 20% of value creation in 2011.

¹⁹ In Espelien et al. (2013) growth is presented in nominal prices, i.e. no account is taken of price growth. The growth presented in Figure 5.24 and the rest of the chapter is in real prices, with nominal prices being deflated using the consumer price index.

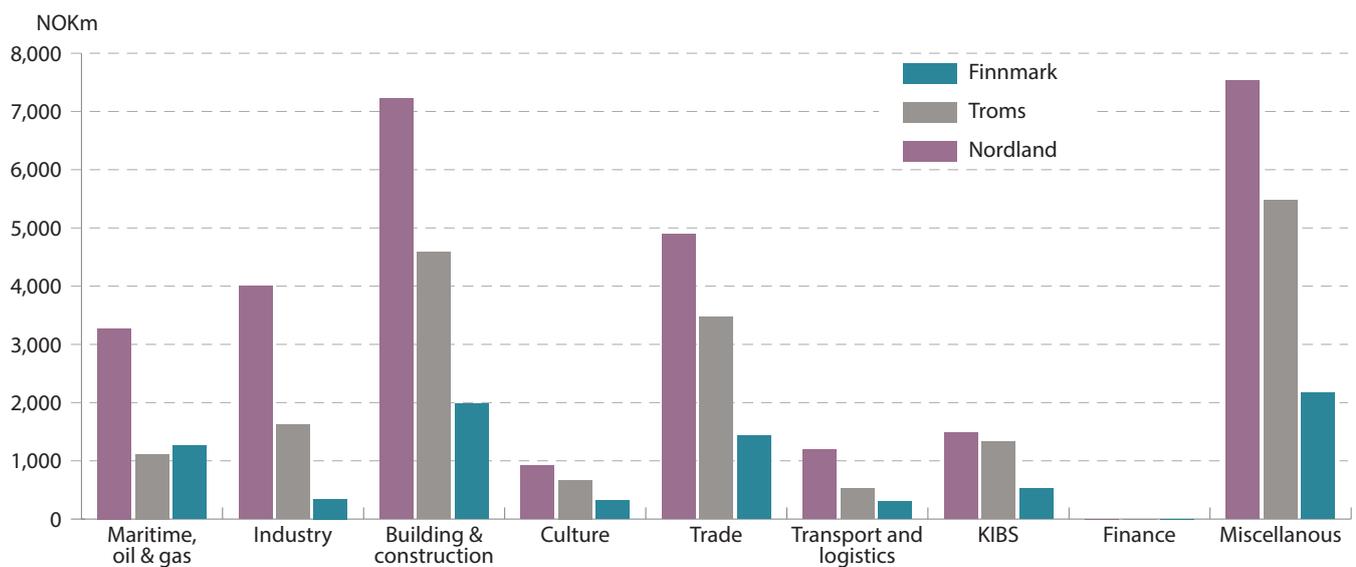
²⁰ Hurtigruten ASA, LKAB Norge AS, Nexans Norway AS, BTN Sjø AS

FIGURE 5.23
Development in value creation in other industry and business by industry, 2004-2011.
Indexed growth, 2004=100



Source: Menon

FIGURE 5.24
Value creation in other industry and business by industry and county, 2011



Source: Menon

Industry also saw growth in the period 2004-2011, but with a marked decline in 2009, mainly as a result of the financial crisis. Results improved substantially between 2009 and 2011.

There was overall growth in value creation in building & construction between 2004 and 2011 despite value creation in the sector falling sharply in 2009. The fall was largely due to poorer results on the part of several of the largest companies, as they did not benefit much from the package of measures implemented to maintain activity during the financial crisis. Smaller companies were in a better position to get involved in building projects that qualified for subsidies. At the same time, uncertainty regarding future municipal finances probably contributed to major investments in public buildings and roads being deferred.

There was fairly steady growth in value creation in the cultural segment in the period, from NOK 1.2 billion in 2004 to NOK 1.9 billion in 2011. Here too the largest enterprises, mainly in the form of NRK, regional newspapers, theatres/museums and printers, are responsible for the growth.

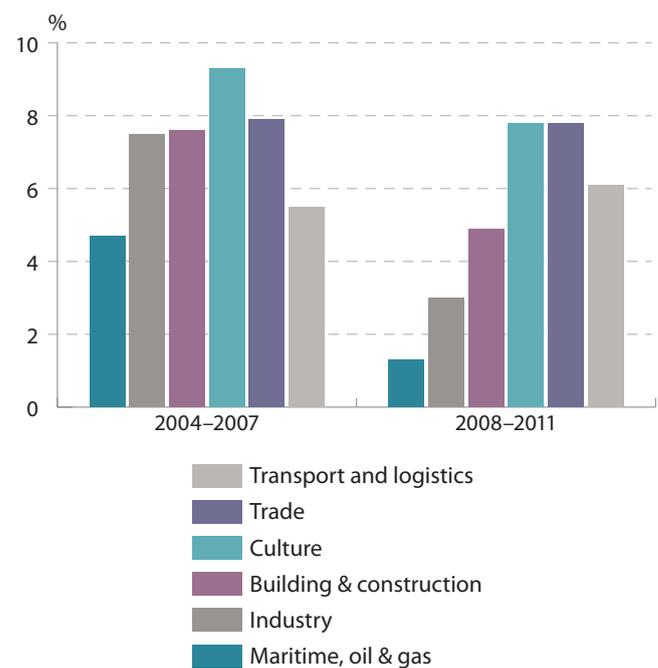
Value creation in the trade segment was NOK 9.8 billion in 2011, growth of 4% from 2008 in real prices (10% nominal growth). Trade in Øst- and Vest-Finnmark had the largest percentage growth, but in money terms Salten achieved the strongest growth.

Value creation in logistics & transport increased from NOK 1.14 billion in 2004 to NOK 2.02 billion in 2011, equivalent to growth of 54% in real prices.

The KIBS segment had value creation of NOK 3.3 billion in 2011, having grown by 85% since 2004. Growth was fairly steady until 2008, when it stagnated somewhat. Growth was negative from 2009 to 2010, but then picked up again.

The finance segment grew from value creation of NOK 3.2 billion in 2004 to NOK 4.2 billion in 2011. Value creation is highest in Nordland, which, together

FIGURE 5.25
Return on investment in other industry and business, 2004-2007 and 2008-2011



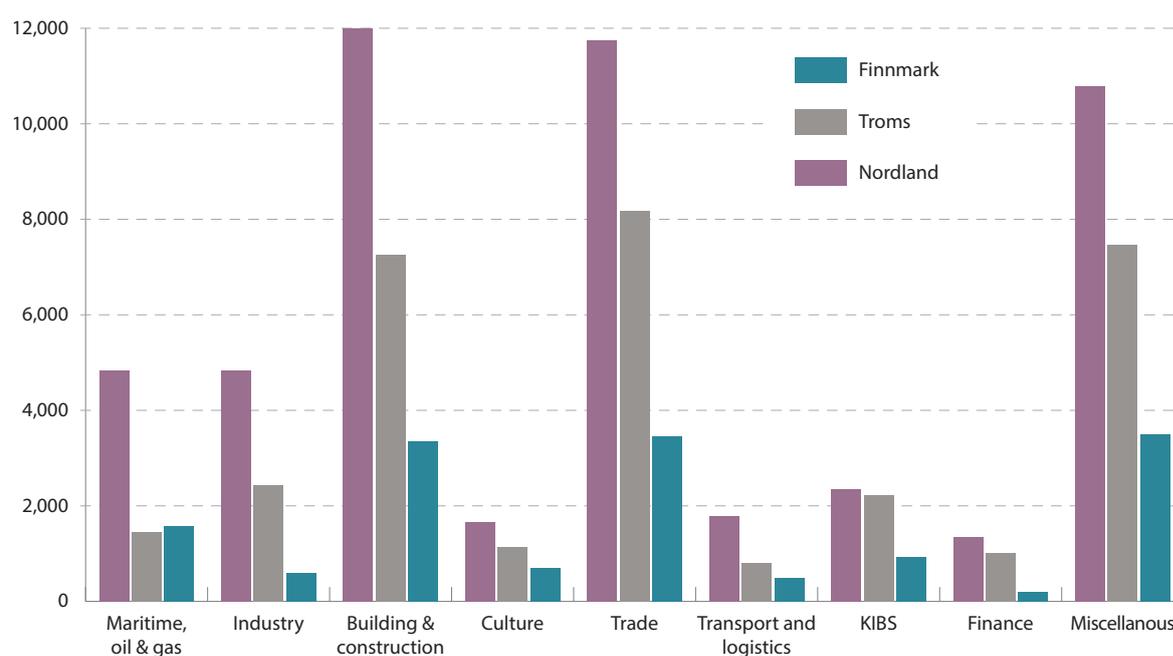
Source: Menon/Soliditet

with Troms, accounted for the growth. Value creation in the finance segment in Finnmark was lower in 2011 than in 2004.

Profitability

Return on investment in other industry and business is very variable between the individual segments and over time. To illustrate development, the period 2004-2011 has been split in two: before and after the financial crisis, i.e. 2004-2007 and 2008-2011. Development in the segments in question, apart from KIBS, finance and miscellaneous, is illustrated in Figure 5.25.

FIGURE 5.26
Employment in other industry and business by industry and county, 2011



Source: Menon

As Figure 5.25 shows, export-oriented activities and building & construction felt the effects of the financial crisis most, while other segments were only affected to a limited extent. Transport & logistics actually had a higher return in the later period. In the first period the selected segments, with the exception of maritime, oil & gas, had a higher return than the total for all industries in Northern Norway, while the picture was more variable in the second period.

Employment

The period 2004-2011 saw growth in employment in all the segments in other industry and business, apart from the miscellaneous category, where development was fairly flat. The largest percentage growth was in KIBS and maritime, oil & gas. In total numbers, growth was highest in local services such as building &

construction and trade, see Figure 5.26. There is reason to believe that this development will continue owing to demand for new housing and commercial premises when other industries grow.

Nearly 7,900 people work in the maritime segment or the supplier industry for oil and gas in Northern Norway. This represents an increase of roughly 60% since 2004. The increase was especially large for oil and gas suppliers, who added nearly 700 employees between 2005 and 2011.

Roughly as many people, 7,850, are employed in industry in Northern Norway. This figure was relatively stable between 2004 and 2011, peaking at close to 8,500 in 2008. The most important subgroup is the food industry with nearly 2,000 employees. As previ-

ously mentioned, Nordland is the industrial county and so has the largest number of employees in industry. In the last four years only the Salten and Nord-Troms areas saw positive development in employment, while Lofoten saw the largest decline, with employment in industry falling by 34% from just over 400 to around 250 people.

Nearly 23,000 people work in building & construction, where the number of employees increased throughout the period. Helgeland, Salten and Tromsø are the biggest areas in terms of employment. The segment consists largely of small enterprises, with the median enterprise in Northern Norway having three employees, while the the mean enterprise is somewhat larger with seven employees.

Total growth in employee numbers in Northern Norway's cultural segment was 22% during the period. This is somewhat lower than growth in value creation during the same period. The only area where the number of employees in this segment fell is Vest-Finnmark.

Trade employs around 23,400 people in Northern Norway. Tromsø has the largest number of employees with just over 4,500, closely followed by Salten. The areas with the fewest employees in this segment are Indre Finnmark and Nord-Troms with 400-500 employees. There was a slight increase in employee numbers in later years, with growth of 2% since 2008. Many of the enterprises in the segment are small, with the median enterprise having turnover of NOK 5.5 million and four employees.

Just over 3,000 people work in logistics & transport. Nordland is by far the biggest county in terms of employment, and over half of the employees in the segment in Northern Norway have their workplace there.

With just under 5,500 employees in 2011, KIBS is not very big in the region (see also footnote 18 on the size of the segment). The number of employees increased during the period, but from a low base. Growth is partly from several start-ups. The number of employ-

ees in the KIBS segment varies widely between areas, with the highest number in Tromsø. In West Finnmark and Tromsø KIBS accounts for nearly 8% of employees in business. The KIBS segment consists largely of small enterprises, with the median enterprise having one employee, while the the mean enterprise is somewhat larger with between two and seven employees.

Employment development was weak in the finance segment, which employed roughly as many people in 2011 as in 2004. There were some changes in regional distribution, with increasing centralisation in the larger areas in Northern Norway.

The miscellaneous category accounts for just under 21,700 employees working in 7,600 enterprises in Northern Norway.

Figures from Statistics Norway show that in 2011 there were 4,500 foreign workers employed in other industry and business in Northern Norway. Nordland has the most foreign employees (1,700), but the relative importance of foreign labour increases the further north in the region you go (1,200 in Troms and Finnmark). Irrespective of county, most are employed in the health service, building & construction, industry and commercial services. The majority of workers come from the Nordic Region or EU Member States in Eastern Europe. Development in the number of foreign workers in the period 2008-2011 varies between the counties, with the number more than halving in Troms, growing in Nordland and being relatively stable in Finnmark.

5.7 Sami business

In addition to the sectoral analyses, a separate analysis was made of the industries that are typically Sami, see Angell et al. (2014). The industries prioritised in the analysis are the primary industries (agriculture, reindeer husbandry, fisheries and aquaculture), and the tourism and cultural industries. Value creation and employment in these industries in the Sami areas are included in the figures presented for each individual industry above, but we have nevertheless opted to present these figures separately for the Sami

TABLE 5.9

Employment and estimate for economic indicators for the prioritised industries in the STN municipalities. Employment in 2012, and economy averaged for 2011 and 2012.

	EMPLOYEES	FULL-TIME EQUIVALENTS	TURNOVER/REVENUE		VALUE CREATION
	NUMBER (REGISTERED)	FULL-TIME EQUIVALENTS IN AGRICULTURE CENSUS AND REINDEER HUSBANDRY	TURNOVER, NOK MILLIONS	VALUE CREATION, NOK MILLIONS	VALUE CREATION PER EMPLOYEE, NOK '000
Agriculture and agricultural industry	630	700	430	170	230
Reindeer husbandry and slaughtering	470	950	370	130	140
Fishing and hunting	690		1,200	620	930
Aquaculture	270		2,000	410	1,430
Fish processing and sales	500		1,800	290	790
Tourism	890		850	340	320
Media and culture	490		380	170	350
Total	3,940		7,030	2,130	540

The figures for fishing and hunting, aquaculture, and media/cultural industries are relatively uncertain

Source: Statistics Norway, NILF, ProffForvalt, Norut Alta-Áltá

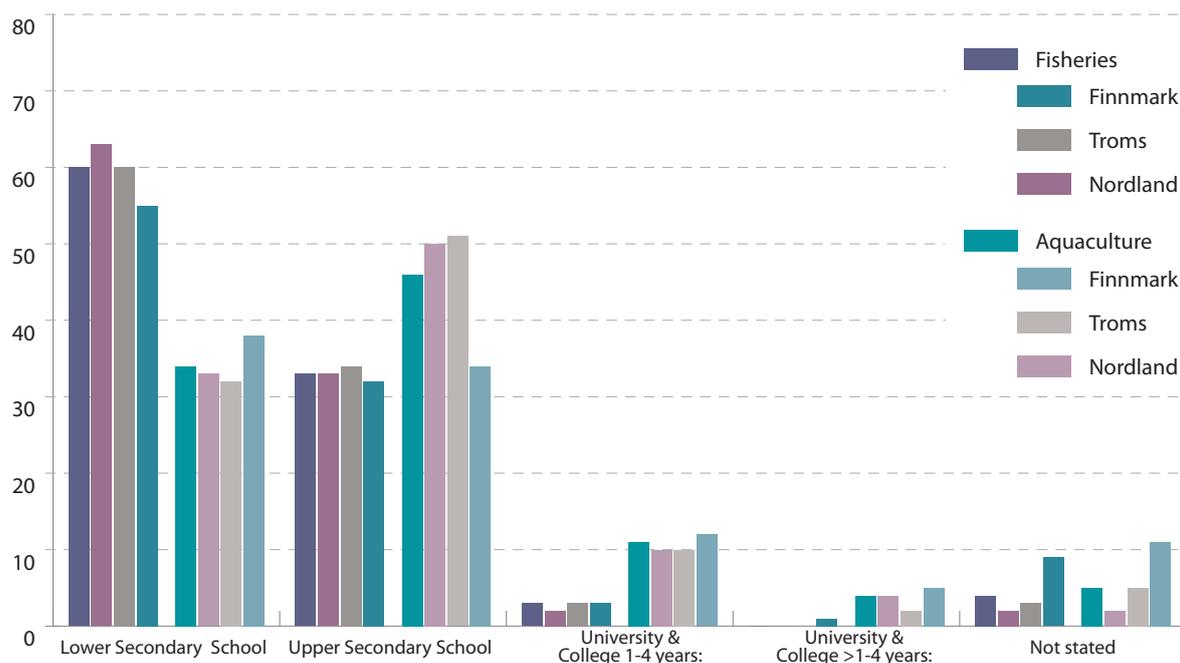
areas. The study covers 22 municipalities in the STN area (area covered by the Sami Parliament's Subsidy Schemes for Business Development).

The land-based primary industries, i.e. agriculture and reindeer husbandry, in the Sami areas are dependent on public subsidies, while reindeer husbandry also relies on compensation schemes. Reindeer husbandry is an important Sami culture bearer, but is increasingly facing challenges in the competition for land areas with new industries. However, there is positive development in the form of growing demand for local food and fewer food miles, opportunities in relation to

Arctic and organic food production, and potential for closer links with tourism.

Fishing and hunting are in a completely different economic position to agriculture and reindeer husbandry. The changes for this industry are to do with recruitment and a lack of delivery options, for example. On the other hand, aquaculture has grown in the STN municipalities and now represents a substantial proportion of value creation in the primary industries, although some of the value creation goes to owners outside the STN municipalities.

FIGURE 5.27
Educational level in fisheries and aquaculture in Northern Norway, 2011.



Source: Statistics Norway

The tourism industry in the STN area faces the same challenges as tourism throughout Northern Norway, only more so perhaps. The STN municipalities are on the periphery, with long distances to large concentrations of population, and have a very limited local market.

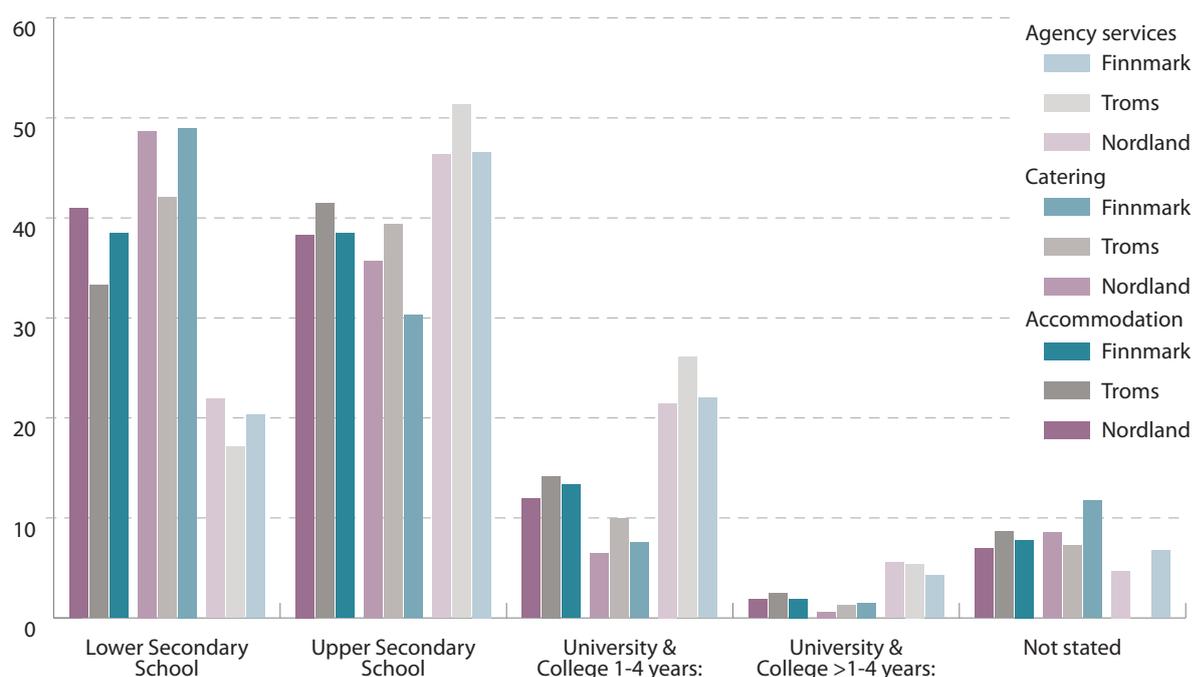
The Sami media and cultural industries stand on their own two feet, although many are dependent on subsidies and profits are limited. A particular challenge faced by Sami media, literature, etc., is the limited Sami-speaking home market. At the same time, Sami music, film, art and crafts have a larger market, and some performers, composers, artists and filmmakers enjoy a much larger audience.

Angell et al. (2014) shows that there are some large economic differences between the industries,

see Table 5.9. The fishing industries have by far the highest value creation per employee, while it is lowest in agriculture and reindeer husbandry in particular. Value creation per employee in the tourism and cultural industries is modest. If this figure had been calculated per full-time equivalent, it would probably have been somewhat higher, as both industries are characterised by part-time and seasonal employment, with fewer full-time equivalents than number of employees. In terms of value creation, aquaculture generates the most per employee, followed by fisheries and then fish processing.

In agriculture, reindeer husbandry, media and culture, operating profit is virtually zero, which means that value creation is made up of payroll costs or remuneration for work. This does not provide much oppor-

FIGURE 5.28
Educational level in the tourism industry in Northern Norway, 2011.



Source: Statistics Norway

tunity to accumulate capital and limits development potential in the industries. The tourism industry in the STN municipalities makes an operating profit overall, but it varies from year to year. In 2011 operating profit represented 15% of value creation, while in 2012 it was just 8%.

It is mainly in fisheries that owners have the opportunity to accumulate capital. In fishing and hunting operating profit made up 40% of value creation in 2011, while the figure was 20% in 2012. In the fish processing industry the corresponding figures were 31% in 2011 and 16% in 2012. Aquaculture occupies a special position in that operating profit, which goes to the owner, represented well over half of value creation in both 2011 and 2012.

5.8 Competence, R&D and innovation in the sectors

As discussed in Chapter 4, education, competence, research and innovation are vital for value creation in a knowledge-based, global world. In a regional context it is important to have an overview of education, research and innovation, not least when it comes to providing a framework for increased value creation.

In the following sections we give an account of competence, research efforts, innovation and cooperation in the sectors covered by the knowledge-gathering project.²¹

²¹ The discussion is based on the sectoral analyses, and differences in the discussion of each individual industry are due to the slightly different approaches taken in the sectoral analyses.

5.8.1 Competence level in the industrial sectors Marine industries

The majority of employees in fisheries have not been educated beyond lower and upper secondary school, with lower secondary accounting for 60% and upper secondary for 33% of the total number of employees in the industry, see Figure 5.27. The corresponding figures for aquaculture are 34% and 46% respectively. In Northern Norway's aquaculture industry approximately 15% of employees are educated to university or college level, while the corresponding figure for fisheries is 3%. Overall, there is positive development in the proportion of employees with higher education, especially in aquaculture and the biomarine industries. The statistics do not include figures for employees with a trade certificate, a category that has become increasingly important in the industry. The proportions of employees based on educational level does not vary much between counties and areas.

The seafood industry requires both graduates with a general education and graduates with a specialist education, e.g. in marine and fishery biology. The education sector from upper secondary school to university has by and large managed to offer the specialist courses that the seafood industry needs, and according to Winther et al. (2013), the problem has rather been one of overcapacity on upper secondary school and university/college courses in relation to the number of young people applying for them. This may also be because the industry has a limited need for recruitment, as efficiency improvements and automation have made it possible to maintain or even increase production while total employment has declined. As far as the fish processing industry is concerned, practical experience and trade certificates are the qualifications most in demand when enterprises take on new employees (Angell et al. 2011). Looking ahead, it is assumed that the industry will have a greater need for personnel with more technical competence, as a greater degree of automation is expected.

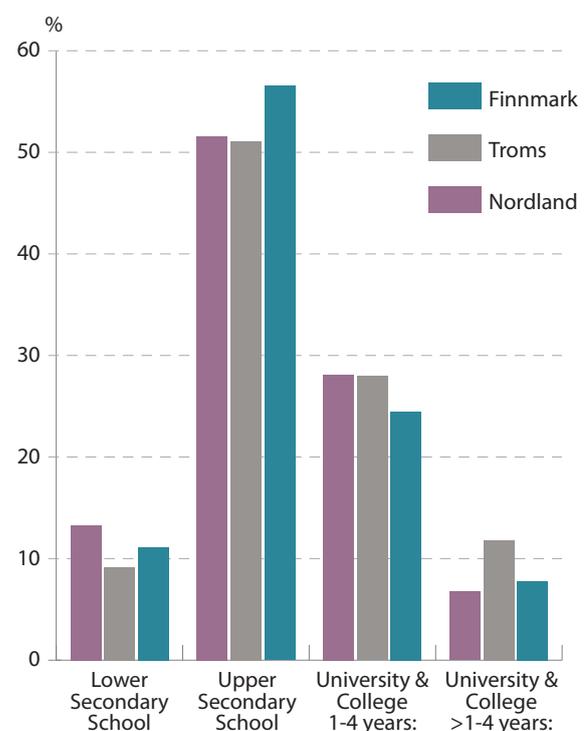
Tourism

In 2011 the tourism industry in Northern Norway had 973 employees with higher education, equivalent to 12% of

the workforce. Of these, 8% (i.e. 1% of the total) had four years or more of higher education, while the rest had between one and three years. These figures cover accommodation, agency services and catering, but not transport and experiences. This is because the last two are divided between a large number of industry codes in Statistics Norway's figures, so there is no specific data for the two segments. The proportion of employees with higher education is highest in agency services at 24%. Then comes accommodation with 15% and catering with 8%. The educational level composition of the tourism industry is illustrated in Figure 5.28.

The proportion of employees with higher education in Northern Norway's tourism industry varies widely for

FIGURE 5.29
Educational level in the renewable energy industry in Northern Norway, 2011



Source: Statistics Norway

the different areas, from 16% in the Tromsø area to 6% in Nord-Troms. The areas with the highest proportion of employees with higher education are Tromsø, Lofoten and Vesterålen, and Vest-Finnmark, all areas where tourism plays a relatively important role. Nord-Troms and Helgeland have the lowest educational level at around 6.5% of employees with higher education. A low educational level indicates that the potential for competence improvement is particularly large in these areas.

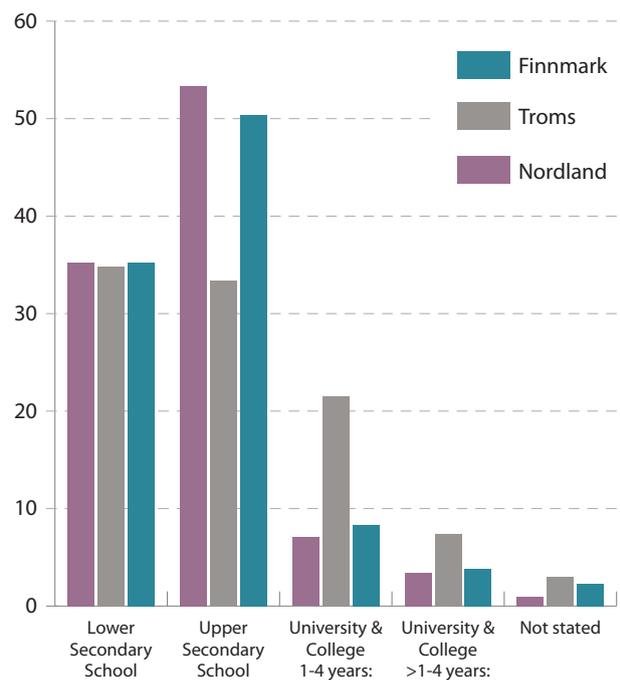
No lines of study stand out in the tourism industry and most employees in tourism fall into the miscellaneous category. This reflects the high proportion of unskilled labour, but also the fact that the lines of study included in Statistics Norway's figures do not pick up typical tourism courses, such as hotel school, various trade certificates (chef, server, etc.), cabin staff training, and maritime or military training.

Renewable energy

The power sector is an industry with a lot of skilled workers, most of whom have upper secondary education and training. There are minor differences between the counties, with a somewhat higher proportion of employees with higher education in Troms than in the other two counties. Figure 5.29 shows the educational level for the sector in the different areas of Northern Norway. While 39% of employees in the sector nationally have higher education from college or university, this figure is all of 56% in Tromsø. Next comes Ofoten, where 39% have higher education. Both of these towns have courses targeted at this sector, while Troms Kraft has its head office in Tromsø and Nordkraft is based in Narvik. The majority of employees elsewhere in the region have upper secondary education and training.

In Nordland, Troms and Finnmark, 65%, 56% and 60% respectively work in natural sciences, the trades and technological professions. In the financial and administrative professions, 14% in the sector in Nordland have this as their specialist field. The corresponding figures for Troms and Finnmark are 19% and 17% respectively.

FIGURE 5.30
Educational level in the mineral industry in Northern Norway, 2011

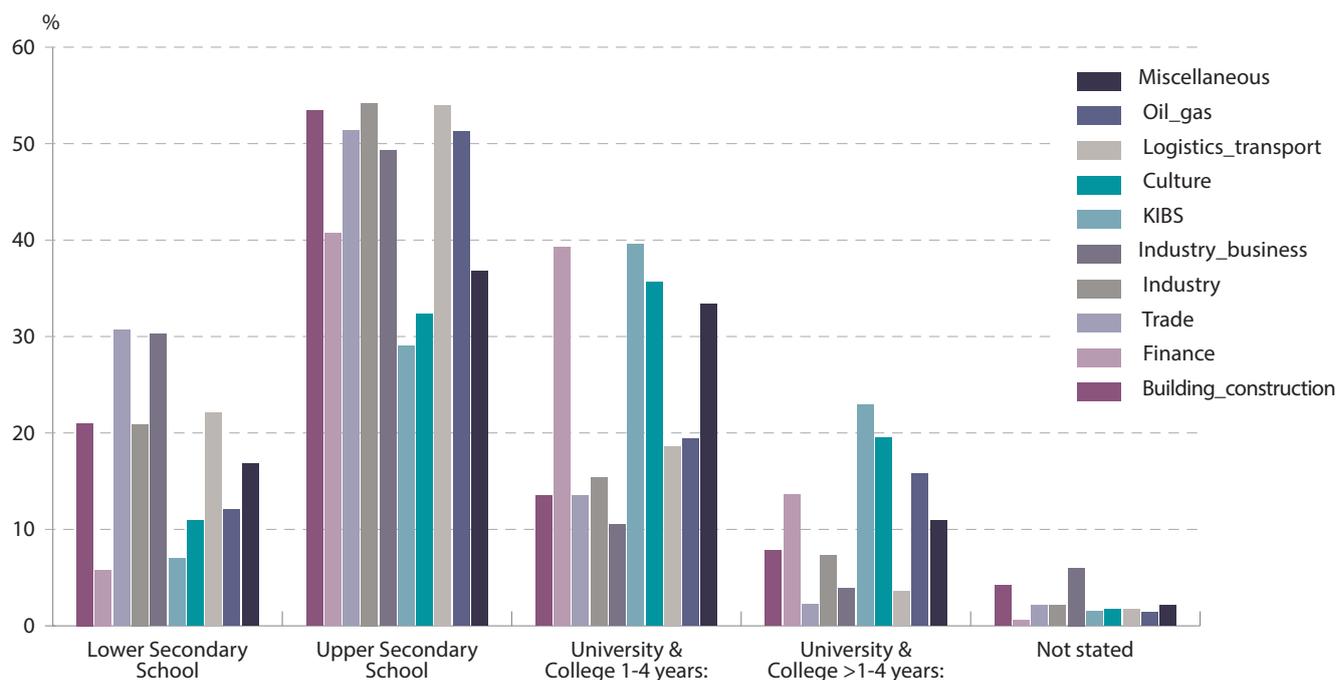


Source: Statistics Norway

Mineral industry

Half of the employees in Northern Norway's mineral industry have not been educated beyond upper secondary school, 35% just have a lower secondary education, while around 12% have a university or college education, see Figure 5.30. Employee competence has been very stable over time apart from the fact that the proportion of university- and college-educated employees increased from 2010 (approx. 9%) to 2011 (12%). This increase mainly came from ore mining. In the largest companies in the mineral industry in Northern Norway the proportion of employees with higher academic qualifications is around 20%. By far the majority of employees have a trade certificate, and in areas where there has been

FIGURE 5.31
Educational level in other industry and business in Northern Norway, 2011



Source: Statistics Norway

mining activity for many years a lot of workers have considerable non-formal competence.

Until recently, Norway's ore industry had been in a state of decline since the 1980s, while there was steady development in industrial minerals, a trend that led overall to a disintegration of competence and relatively weak focus on education and training targeted at the industry in recent decades. Meanwhile, the petroleum industry has expanded in the last 20 years, attracting geologists and engineers on a large scale, which may have implications for development in the industry.

Other business

The proportion of employees with higher education is lower in several of the segments in other industry and

business in Northern Norway than in equivalent segments nationally. The segments that stand out for both a low proportion of employees with higher education and large differences in relation to the segment nationally are maritime, oil & gas, building & construction, and industry, see Figure 5.31.

The specialist composition of this composite industry is very similar to the national education profile. While there is a slight preponderance of competence in miscellaneous subjects and social/legal subjects in Northern Norway relative to the number of employees, there is a corresponding slight shortfall of employees with qualifications in economics, natural sciences and health-related subjects. Miscellaneous is the predominant line of study in six out of nine segments, with more than 50% of

employees falling into this subject category. Natural sciences, the trades and technical subjects predominate in building & construction and industry. There is a larger proportion of employees with this professional background in maritime, oil & gas and logistics & transport too. Economics and administration are strongly represented in both the finance segment and KIBS segment. A background in health-related subjects is most strongly represented in the miscellaneous segment.

5.8.2 R&D, innovation and cooperation in the industrial sectors

Marine industries

Marine R&D is a significant field of research in Norway, and about 7% of Norway's total R&D expenditure in 2011, NOK 3.2 billion, was spent on marine R&D. Northern Norway accounted for a fifth of this research. Tromsø is Northern Norway's main centre for marine research, but marine-oriented research also takes place elsewhere in Northern Norway. All of 64% of marine-oriented research was publicly funded in 2011, as against 46% of all research. The business community's share of funding has been growing by about 1% per annum since 1999, however. The last 12-14 years have seen strong growth overall in the scope of marine R&D, with 7% per annum (real growth) in the period 1999-2009. Growth has stagnated in the last two or three years, however, with annual real growth of 1.5%.

Around 31% of marine research, NOK 988 million, was in aquaculture in 2011. Northern Norway accounted for about a fifth (17%) of this research too. Business was responsible for a much larger share of aquaculture research than marine research in general.

A smaller proportion of enterprises in the marine sector in Northern Norway seem to be doing their own R&D than in the marine sector in the country as a whole, but the marine industry is more R&D-intensive than business in the region in general. About a third of all enterprises in the marine sector in Northern Norway have their own R&D, while the corresponding figure for Norway as a whole is 41%. Not surprisingly, bio-

technology enterprises also boost the proportion of enterprises with their own R&D in the marine sector.

Of the enterprises in the marine sector in Northern Norway that had their own R&D in 2010, 14% spent in excess of NOK 10 million on it, and 43% NOK 1-10 million. A total of 24% of enterprises in the marine sector bought or received R&D from other companies in 2010.

For the marine industries at a whole, more than 40% of enterprises in both Northern Norway and the rest of Norway introduced some form of innovation in the period 2008-2010. In the different segments in the marine sector enterprises in biotechnology and fish processing (food, beverage and tobacco industry, including production of fish feed) have a higher degree of innovation than enterprises in fisheries and aquaculture.

For marine enterprises process innovations are more common than product innovations, relatively speaking. This suggests that the sector focuses more on improving efficiency and reducing costs in production and less, relatively speaking, on developing new products. Although it is nevertheless more common in relative terms for enterprises in the marine sector to introduce new products than in business in general, this may indicate that consideration should be given to implementing measures to strengthen market orientation in marine enterprises.

Close to 30% of enterprises in the marine industry in Northern Norway state that they cooperated on innovation in the period 2008-2010. This is roughly the same as the mean for all industries in Norway, but much lower than for enterprises in 'fishing, hunting and fish farming' nationally. At national level the pattern of cooperation on innovation for enterprises in the marine sector is different to that for the rest of the business community. It is less common to cooperate with customers, but more common to cooperate with public or private research institutes, and with commercial laboratories/R&D companies. A larger proportion of enterprises in the marine industry in

Northern Norway than marine enterprises nationally give customers and suppliers as their most important cooperation partner for innovation. Research institutes are also distinctly less important and consultants correspondingly more important for Northern Norway's marine enterprises. The reason for the difference in cooperation pattern is not clear, but may be explained by access to potential cooperation partners in the immediate area/region.

Northern Norway has relatively few strong business clusters in the marine sector. There are strong fishing environments in Øst-Finnmark, Lofoten and Senja. Nordland has a strong aquaculture environment in and around NCE Aquaculture. In the Tromsø area there is a strong research-based environment in biotechnology and biomarine industries.

Tourism

Cooperation with R&D institutions is limited in the tourism industry, although tourism research is conducted at Nordland Research Institute, University of Nordland (UiN) and the Arctic University of Norway's Alta campus. The weak links between industry and R&D are due in part to a low level of formal qualifications and the fact that enterprises are small and fragmented, as well as being geographically scattered. Several analyses (e.g. Jakobsen and Espelien, 2010) have also shown that the tourism industry has traditionally had relatively little innovation.

Increased emphasis on experiences and cooperation in enterprise networks in destination development have strengthened links with R&D. Tourism as experienced-based business development has become an action area for research and education that is supported by universities, colleges and the institute sector. This is reflected in the Programme for Regional R&D and Innovation (VRI) and county plans, prioritisation of innovation in enterprise networks under the Arena Programme, and destination prioritisation as part of the enterprise network scheme. Collaboration between industry and relevant R&D has been strengthened through the NORD-SATSING initiative and the 'Opplevelser i Nord' project.

Arena tourism projects are of great importance when it comes to making tourism enterprises more innovative and strengthening links with R&D and education. The 'Innovative Experiences' project, which was implemented in northern Nordland in the period 2008-2012, was an important arena for knowledge development, both in the enterprise network and by passing experiences on to other projects such as 'Opplevelser i Nord' and VRI (Oxford Research, 2012). The Arena project gave rise to new cooperation constellations, including the 'Arctic deLight' enterprise network in Vesterålen, which focuses on the development of northern lights tourism. The project also established links with NCE Tourism, the 'Rewarding Winter Experiences' Arena project and a number of other enterprise networks in the country. Another outcome was the Northern Norwegian Experience Conference, which has become an important meeting place for the experience industries in the north, with international links and contributors.

Growth in the experience-based part of the industry has contributed to a transition from standard products to more profitable products with considerable innovative content. Such innovations can consist of new products/services, processes and market-related or organisational improvements. The majority of experience enterprises in Northern Norway invest in innovation and product development.²² There is most innovation in enterprise networks, which can be seen as an organisational innovation in itself. The networks play an important role in improving collaboration and developing integrated destinations. They help to boost enterprises' core competence in creating experiences individually and in networks, and provide a basis for increasing customers' willingness to pay with better preparation and dramatisation.

The survey that was conducted as part of the sectoral analysis for tourism shows that 64% of enterprises have

²² See, for example, Report No. 10/2011 by Nordland Research Institute: Delrapport nr 2 fra forskerprosjektet VRI Nordland, Nordland Research Institute Memo 1010/2010: Midtveisundersøkelse av bedriftene i Arena Innovative opplevelser, and Nordland Research Institute Memo 1011/2010: Innovasjonsundersøkelse blant bedrifter innen opplevelsesbasert reiseliv på Helgeland. (Nordlandsforskning, 10/2011) (Nordlandsforskning, 1010/2010) (Nordlandsforskning, 1011/2010).

implemented product innovations, 68% market innovations and 48% process innovations in the last three years. It is uncertain whether the enterprises that innovate a lot have higher growth and profitability than other enterprises, but there is a positive (and statistically significant) correlation between number of innovations and all innovation results. The more innovations enterprises implemented, the greater the impact of the innovations on production capacity and flexibility.

Renewable energy

Several of the educational and research institutions in Northern Norway have sound competence in renewable energy. Important institutions include:

- Norut (Northern Research Institute), which focuses on solar energy, bioenergy, thermal power and wind power. Norut has the most renewable energy R&D in Northern Norway's institute sector and is responsible for Nordland's prioritisation of renewable energy under the VRI programme.
- Nordland Research Institute, which, among other things, carries out accompanying research for the renewable energy action area under the VRI programme in Nordland, including the basis for commercialisation of wind power and problems with regard to competing use of areas and natural resources.
- Narvik University College, which, among other things, offers bachelor's degrees in renewable energy and electrical engineering/electronics, a master's degree in integrated building technology and a master's degree in electrical engineering.
- UiT The Arctic University of Norway, with an 'Energy, Climate & Environment' master's programme. The university also conducts research into fusion energy, wind power, solar energy and geothermal energy, and has several cooperation partners locally, nationally and internationally.
- The University of Nordland offers a master's programme in energy management.

A number of research institutions are involved in the 'Fornybar energi i LOVEs' and 'Energilab'en Dyrøy' projects. 'Fornybar energi i LOVEs' is an intercounty cooperation project between Nordland and Troms, the purpose of which is to help increase activity on all fronts in renewable energy in the LOVEs area (Lofoten, Ofoten, Vesterålen and Sør-Troms), see LOVEs (2011). 'Energilab'en Dyrøy' has as its vision the creation of a leading knowledge environment within the production, distribution, management and optimisation of different energy carriers from a small-scale perspective, and is a development arena between business and research.

VRI Nordland has renewable area as an action area with the emphasis on solar energy, bioenergy, small-scale power plants and offshore power.

The industry's perception of the level of innovation in the sector varies according to segment. Examples of innovation needs include operating challenges for wind power in Arctic regions and test installations for tidal power.

A number of renewable energy cooperation projects involving many players with complementary competence are under way in Northern Norway. Two important projects are:

- G8, a cooperation forum consisting of eight power companies in Finnmark, who aim to benefit from each other's experiences.
- LUEN (Supplier Development for Energy Investment in the North) under the auspices of Statkraft, Statnett and Innovation Norway. The aim was to contribute to the development of a competent, strong and competitive supplier industry for the energy sector in Northern Norway. The project has now ended.

Mineral industry

R&D in minerals is in a poor state in Norway. "*The Norwegian mineral industry, together with the research infrastructure, has been run down over several years and new industrial prioritisation will therefore have to be*

built up virtually from scratch" (Research Council of Norway, 2012). The Research Council of Norway's support for research relating to mineral resources was around NOK 25 million in 2011 (Ministry of Trade and Industry, 2013). It involves several programmes and schemes, such as the SkatteFUNN tax incentive scheme, User-Driven Research-Based Innovation (BIA), Maximising Value Creation in the Natural Gas Chain (GASSMAKS), The Oceans and Coastal Areas (HAVKYST), CLIMIT, Centres for Research-Based Innovation (SFI) and the Industrial PhD Scheme (NAERINGSPHD).

UiT The Arctic University of Norway (formerly the University of Tromsø) offers geology and geophysics programmes at bachelor, master's and PhD level. The majority of graduates go into the oil industry, but some also choose a career in the mineral sector. UiT has received funding from the Ministry of Foreign Affairs for a new professorship in ore geology, which will make the geology environment at UiT more relevant to the mineral industry. UiT is cooperating with Luleå University of Technology in Northern Sweden and Oulu University in Northern Finland on a joint Nordic master's programme with the title 'Nordic Mining School', which will start in autumn 2014.

Kjeøy Research & Education Center in the Municipality of Lødingen in Nordland is a teaching and research centre specialising in mining pollution. The centre is developing new methods for improving extraction processes by dissolving minerals and leaching metals.

Several processes are under way with a view to strengthening cooperation between enterprises and knowledge players, both within R&D and in order to establish and develop relevant courses at all levels in the region. One example is the creation of an introductory course in the mine engineering programme on Svalbard based on cooperation with Narvik University College (HiN), Longyearbyen Community Council, the Norwegian Society of Engineers and Technologists (NITO), the Store Norske mining company and Leonard Nilsen & Sønner AS.

R&D and innovation are important for the mineral industry for several reasons, including improving competitiveness, boosting value creation through increased further processing and reducing environmental pollution. As things stand, R&D and innovation in the industry in the north mainly relate to automating extraction processes and making them more efficient. Such measures are of direct importance when it comes to ensuring competitiveness and dealing with challenges linked to securing a reasonable amount of labour. Few of the major mineral companies in Northern Norway have their own budgets for innovation and/or strategic and targeted R&D programmes, however. There is R&D activity though, and many companies express strategic awareness and thoughts concerning R&D even if this is not formalised in a separate R&D strategy.

The mineral industry in Northern Norway does not function as a business cluster to any great extent. Enterprises are tied to specific locations at a considerable distance from each other. Historically there have been few meeting places for players. Competitive considerations, particularly within the industrial mineral industry, has also contributed to secrecy regarding processes.

In order to remedy the lack of cluster cooperation, the mineral industry has taken the initiative to set up a cluster called Mineral Cluster North. The players in the cluster represent the entire value chain in the mineral industry and consist of 20 enterprises, 10 knowledge and R&D environments, and important supporting players in both the public and private sector. The objective is to contribute to growth in activity, value creation and employment in the mineral industry through increased cooperation, prioritisation of knowledge and international orientation.

Mineral Forum Finnmark, a cooperation forum for players in the industry and interest groups, has been set up in Finnmark. It aims to increase value creation from the mineral resources in the county. Finnmark County Council and Finnmarkseiendommen have also

set up 'The Mineral Project in Finnmark' with the aim of assessing the mineral industry's potential and consequences for other stakeholders, and improving communication between these parties.

Other industry and business

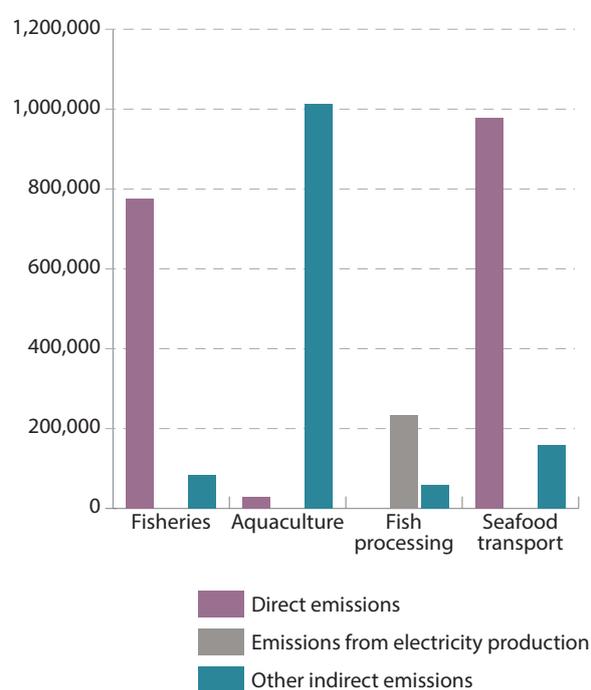
It is the support industries, such as knowledge services and IT, that are Northern Norway's most R&D intensive (Enger et al., 2013 b). These industries spend 8-11% of their revenue on R&D. Industries like building & construction and trade are not very R&D intensive.

Several of the enterprises told Statistics Norway in the R&D survey that they had done their own R&D. KIBS, telecoms & media (culture) and offshore stand out as being especially R&D intensive in the region, with a high proportion of enterprises conducting their own R&D and a high proportion of turnover being spent on it.

The enterprises in Statistics Norway's R&D survey stated that together they had spent NOK 437.4 million on development costs connected with the development of products and services in 2012. Several of the informants in the knowledge-gathering project state that they have employees with research competence working on R&D in the enterprise. The enterprises also say that they have access to R&D developed by divisions outside the region.

The importance of local alliances varies from industry to industry. There is a natural dividing line between export-oriented enterprises and local services. Another dividing line runs between enterprises that win tenders in competition with other suppliers, e.g. building & construction, KIBS and transport, and enterprises where customers actively seek them out, e.g. local trade and the finance industry. When it comes to the tender market, many enterprises choose to enter into cooperation/alliances, with 44% of the enterprises that took part in the survey in the sectoral analysis of other industry and business stating that they were dependent on alliances to be competitive, and that many of their alliance partners were located in Northern Norway.

FIGURE 5.32
Summary of climate accounts for fishing, aquaculture, fish processing and seafood transport connected with Northern Norway by emissions type. Tonnes CO₂ equivalent



Emissions coefficient for electricity production is equal to the so-called Nordic mix, i.e. 0.17 kg CO₂/kWh

Source: SINTEF

5.9 Greenhouse gas emissions

As mentioned in Chapter 4, several of the industries analysed in the knowledge-gathering project are both area intensive and based on harvesting natural resources, so they will face a number of environmental challenges. Many of the activities are regulated by concessions or licences of various sorts, and have to carry out environmental analyses in accordance with planning and building law. The underlying principles

for licensing in Norway are that the pros and cons of a licence must be considered on an integrated basis, and that general interests, such as the environment, climate, landscape, outdoor activities, other industries, the local community and society as a whole, must be taken into account. We assume that the activities, regardless of whether they are subject to licensing or not, are conducted in accordance with their licences and other regulations.

In this section we take a closer look at greenhouse gas emissions in the various industries. To put these emissions into perspective, total Norwegian greenhouse gas emissions are approximately 53 million tonnes CO₂ equivalent.²³

Marine industries

Compared with other food production, greenhouse gas emissions from the marine industries are small. Based on the amount of fish caught, farmed and processed in Northern Norway, fish processing has the lowest CO₂-equivalent emissions, while fisheries and salmon/trout farming are higher. Transporting seafood makes a substantial contribution to greenhouse gas emissions, but this varies enormously depending on the means of transport used. Transporting fresh fish by air produces the largest emissions of greenhouse gases per kilo of fish transported.

Figure 5.32 shows the climate account for fishing, aquaculture, fish processing and seafood transport connected with Northern Norway, broken down according to where in the process the emissions occur. The total comes to around 3.33 million tonnes CO₂ equivalent, which represents a good 6% of total Norwegian emissions. It is important to be aware, however, that many of the indirect emissions occur outside Norway, in other words they do not appear in the Norwegian climate account. If we just consider direct emissions, they represent 1.78 million tonnes, and a large proportion of them will occur in the transport of

²³ As different methods are used to calculate greenhouse gas emission in the individual sectoral analyses, it is not possible to add the figures up to provide an overall picture of emissions from the industries covered by the knowledge-gathering project.

TABLE 5.10
CO₂ emissions relative to power production over life cycle for various sectors.

TECHNOLOGY	INSTALLATION TYPE	g CO ₂ /kWh
Hydropower	Reservoir	4
Wind power	Land-based	12
Bioenergy	Various sources	18
Concentrated solar energy	Parabolic trough	22
Solar cell installation PV	Crystalline solar cells	46

Source: (IPPC 2011).

seafood from Northern Norway to Southern Norway (transport related to export is not included). The direct emissions come almost exclusively from burning fuel, i.e. from transport. The majority of indirect emissions occur in feed production for aquaculture, i.e. in fisheries and agriculture around the world.

Tourism

Calculating climate impacts and emissions for tourism in both Norway and Northern Norway presents a number of challenges, in part because tourism is not a separate sector in government statistics, the different activities that make up the industries have varying climate emissions, and climate statistics for transport do not differentiate between tourists and other types of passenger transport.

Assuming that the three counties of Northern Norway are responsible for the same proportion of CO₂ emissions and greenhouse gases as their share of national tourist consumption, Northern Norway accounts for around 10% of tourism's total emissions.

This corresponds to around 600,000 tonnes of CO₂ emissions per annum (1% of Norwegian emissions). There may be reason to assume that winter tourists travel more by air to Northern Norway owing to there being fewer transport options. Long distances to the most important foreign tourist markets may indicate that the proportion of transport activity will be higher for Northern Norway than other parts of the country.

Renewable energy

Renewable energy has few or no greenhouse gas emissions during the operating phase, but there can be substantial emissions when the installations are manufactured.²⁴ It is therefore of interest to look at greenhouse gas emissions per kWh generated over the whole life cycle. A number of studies have been carried out internationally comparing greenhouse gas emissions relative to production figures over the life cycle of different renewable energy technologies. The UN's climate panel (IPCC) has compared findings from several hundred research reports and the results from that comparison are presented in Table 5.10.

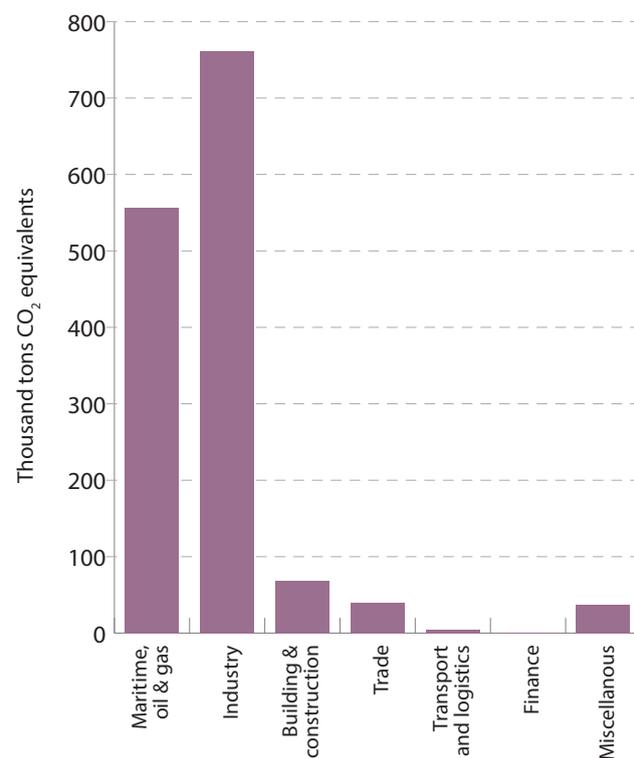
Other life cycle analyses produce different figures, in other words there are large variations in emission figures for the different renewable systems, partly based on the assumptions made. One trend, however, is for wind power to do well compared with most other electricity generating systems when the criterion is the lowest possible greenhouse gas emissions. This is particularly true in relation to solar cells and geothermal energy. The difference is smaller in relation to hydropower and wave power, while the results for tidal power and concentrated solar energy are comparable with wind power.

Mineral industry

The sectoral analysis for the mineral industry, Vista Analyse and Sweco (2013), does not contain concrete figures for CO₂ emissions from the mineral industry. The largest emissions are presumably from machinery and transport, with some enterprises in the sector using several million litres of diesel a year, but it is

24 In the case of bioenergy, this mainly concerns production of the energy source.

FIGURE 5.33
Emissions of CO₂ from other industry and business in Northern Norway, 2011



Source: Menon, Statistics Norway

difficult to differentiate between use in operations as such and transport. Generally speaking, emissions from the mineral industry are assumed to be small.

Industry and other business

Owing to the composition of other industry and business, it is difficult to generalise about the environmental challenges associated with these industries. Area- and/or energy-intensive industries, like some industry, building & construction and transport, could have the same impacts on nature and the environment as described above for renewable energy and the mineral industry. Service industries will generally

have a small impact on nature and the environment, as well as having limited greenhouse gas emissions.

Based on Statistics Norway's greenhouse gas figures, Espelien et al. (2013) distributed total national emissions in Norwegian trade and industry on the basis of how large a proportion of total turnover enterprises in Northern Norway account for. This assumes that enterprises operating in the same industry have roughly the same emissions profile in Northern Norway as in the rest

of the country. Total emissions from other industry and business in Northern Norway were calculated at 1,469 million tonnes of CO₂ (not quite 3% of total Norwegian emissions, with the breakdown for the various industries as shown in Figure 5.33.

The export-oriented industries, i.e. industry and maritime, oil & gas, have the highest CO₂ emissions, with roughly 90% of total emissions from this composite sector.

6

Challenges and policy instruments

Photo: Per Eriksson, Visitnorway.com, Narvik

We have all left traces in the north-facing tapestry. Threads and ribbons woven between different people, communities and cultures. Where life lived and historical events can be seen in the pattern that appears. A pattern created by opportunities. Grasped by the people of the north. We have used knowledge, entrepreneurship and innovation to overcome obstacles. By trial and error, down the years and generations. Like a boat swelling in its encounter with the sea. Like fish being dried in its encounter with wind and weather. Thus north-facing opportunities have been chiselled out and tempered through encounters between people and barriers. And new patterns will emerge. For every opportunity grasped. For every challenge met. North-facing patterns that bind past and future together. Woven by the people and resources of the north.

Kriss Rokkan Iversen

Northern Norway is rightly described as a region rich in resources. Its proximity to abundant natural resources and premium raw materials that are in demand furnish it with great opportunities and advantages. Its rich resource base and future possibilities are described in detail in Chapter 4. However, the region faces a number of challenges when it comes to realising the possibilities offered by its natural resources. This chapter takes a closer look at some of the general challenges and barriers preventing the region's value creation potential from being exploited, and investigates the policy instruments that can be employed to deal with the challenges and unleash that value creation potential.

6.1 General challenges

There are large differences in the challenges and barriers affecting the various industrial sectors, and in several areas a more industry-specific approach will be needed to describe the challenges with sufficient nuance. Northern Norway is a geographically sprawling region with a very varied industrial structure, and it cannot be assumed that the challenges are relevant throughout the region and in all the industries. This section describes the general challenges highlighted in several of the sectoral and cross-sectoral analyses. Anyone wishing to delve deeper into the challenges faced by the different sectors will find the relevant information in the sectoral and cross-sectoral analyses. The challenges examined in this chapter are to do with labour, competence and education, research and innovation, infrastructure, capital and area availability.

6.1.1 Labour is a limited resource

Obtaining enough people to boost value creation represents a challenge for Northern Norway. Angell et

al. (2013) estimates that the region's labour requirements will increase substantially in the years up to 2030, partly owing to economic growth and new public services, and partly owing to natural wastage. Several areas in Northern Norway will continue to experience population decline and an ageing population, with the result that they will not be able to meet their labour requirements. This means that the necessary labour will have to be recruited externally, from either Southern Norway or abroad. But even if we take a scenario with high immigration as a basis, labour force growth will be inadequate. Consequently, there will be shortages and competition for Northern Norway's labour force, with the industries that are most profitable and can offer the best pay and conditions being most successful when it comes to recruitment.

These challenges can be illustrated with an example taken from the tourism industry. Although strong growth in international tourism has been predicted, it is not certain that Norway and Northern Norway will manage to claim their share of this market growth. The tourism industry is labour intensive and has pay levels that make it difficult to compete in the international market. Since the industry is also less profitable than competing industries in the region, it cannot offer the pay that would enable it to compete for the best competence. This means that pay levels are both too high and too low at the same time. In a Northern Norway where labour is in short supply, it will be a challenge for tourism, as a relatively unprofitable industry with large labour requirements, to increase profitability in order to attract and retain competent labour. This challenge applies to the labour market in Northern Norway in general, but is especially striking in the tourism industry perhaps.

6.1.2 Low competence and educational levels

It will also be a challenge for business in Northern Norway to obtain labour with the right competence. This is particularly true in the case of skilled workers with higher vocational training. In a study carried out for the Business Tendency Survey for Northern Norway in spring 2013, 40% of business leaders in Northern Norway said that they had problems obtaining competent labour (Menon and Bedriftskompetanse, 2013). Asked what type of competence they had trouble obtaining, all of 73% replied that they could not get hold of enough skilled workers. From this perspective, the fact that so many pupils in Norway are not completing upper secondary education – with this being even more of an issue in Northern Norway – is a very serious problem. Figures from Statistics Norway¹ show that, whereas 75% of all pupils who embark on upper secondary education in Oslo complete it within 5 years, the corresponding figure is 62% for Nordland, 63% for Troms and 47% for Finnmark.

If we look at the educational level in fisheries and aquaculture in Northern Norway, we find that the proportion of employees with at least upper secondary qualifications is much lower than in the rest of the country. There has been positive development in the industry's competence level in recent decades, but according to Damvad et al. (2013), the differences between north and south nevertheless indicate that there is considerable improvement potential in raising the educational level in the seafood industry. This applies equally to the proportions with upper secondary and higher education.

The fact that the competence level is lower than in the rest of the country for higher education will also be a challenge for Northern Norway. The relative deficit in formal higher education applies to all sectors and industries in Northern Norway. Although the region has caught up slightly in recent years, the proportion of employees with higher education in private enter-

prises in Northern Norway is nearly half that in the rest of the country.²

6.1.3 Limited research and innovation

Compared with the rest of the country, Northern Norway as a whole has a lower level of investment in research and innovation. There are large differences within the region, however. Public research funding in Troms is higher than the national average, but well below it in Nordland and Finnmark. Boosting the whole region is made challenging by large distances and differences in industrial structure. It cannot be assumed that strong prioritisation of research in Tromsø will benefit the whole region. The decentralised structure of settlement and industry in the region, with few strong centres of expertise, will make it especially challenging to create meeting points for business and business-oriented research.

Damvad et al. (2013) finds that, whereas R&D investments are increasing in Norwegian trade and industry overall, they are declining in Northern Norway. This weakens enterprises' innovative capacity and means that they miss out on opportunities to develop new products, services and processes. Less prioritisation of research and development in Northern Norwegian business will also result in enterprises being less able to obtain and benefit from public research funding.

The seafood industry is one of the few sectors in which Norway has knowledge environments that lead the world, and the proportion of innovative enterprises in the marine industries is high both in Northern Norway and nationally. There are no official innovation statistics for tourism, but according to Jakobsen (2012), the tourism industry in Northern Norway is more innovative than in the rest of the country. Having said that, Damvad et al. (2013) describes the national research effort in tourism as "non-existent" in relation to the number of people employed in the industry.

¹ See Gjennomstrømming i videregående opplæring 2007-2012, <https://www.ssb.no/utdanning/statistikker/vgogjen>

² In Northern Norway 16.1% of employees in the private sector have higher education in the form of a bachelor's or master's degree, while the corresponding figure for the rest of Norway is 24.9%.

One area of research of great importance to fisheries is the work being done to maintain commercial fish stocks at a stable, high level and reduce annual quota fluctuations. The challenges presented to both fisheries and tourism by seasonal fluctuations are another area where research and innovation are needed.

In the case of aquaculture and the mineral industry R&D is needed to solve environmental problems. R&D is important for the mineral industry in terms of finding sustainable and more efficient ways of handling and exploiting mine waste, for example, while aquaculture needs to solve problems to do with escape and the spread of disease/parasites.

6.1.4 Limitations in infrastructure

One of Northern Norway's advantages in an industrial context is its proximity to abundant natural resources and premium raw materials that are in demand. One of the region's challenges is its geographical location, far from the large national and global markets where the goods produced are in demand. According to Hanssen et al. (2013), transport infrastructure and its year-round functionality are important for regional value creation. Limitations in the capacity and standard of both road infrastructure and ferry links present challenges for several industries.

The marine industries in Northern Norway have transport needs in that they have to both send out large product volumes and bring in input factors, a problem that is exacerbated by the decentralised location of enterprises and remoteness from international markets.

In the case of tourism poor accessibility, especially in aviation, is an obstacle to attracting tourists to Northern Norway. The Lofoten and Helgeland areas are the spearheads of the region's commitment to tourism, but neither has a main airport where large planes can land. In particular, this reduces the possibilities for increasing volumes in the course/conference market and in the low season, something which is very important with regard to the possibility of year-round prioritisation of tourism.

In the case of the renewable energy sector the infrastructure bottleneck is lack of grid capacity. Within Northern Norway, capacity from Ofoten up to Hammerfest and on to eastern Finnmark in particular is inadequate. Statnett has concrete plans to upgrade this part of the grid by 2020, however. Both grid capacity and production are good in Nordland south of Ofoten, but this area has a substantial power surplus. Northern Norway already exports 5 TWh annually. The potential for increasing production of renewable energy in Northern Norway is considerable. But as long as the sum of demand for power in the region and export capacity out of Northern Norway is lower than production potential, export capacity will limit value creation in the sector.

Internal communications and accessibility in Northern Norway are important in view of the increasing need for labour in the region. Northern Norway consists of a large number of small, not very flexible labour market regions where it can be difficult for people to find suitable work, and challenging for enterprises to source the right competence. Enlarging the labour market regions and improving internal transport in the region may make it more attractive to live and work in Northern Norway by creating more flexible labour markets and service provision. However, the large distances mean that the potential for labour market enlargement is limited.

Another challenge highlighted by Hanssen et al. (2013) is the approach to planning. As the present infrastructure is of poor quality and there is a long-standing maintenance backlog, all sorts of acute needs arise, with efforts being made to solve them ad hoc. This can be at the expense of larger and more integrated infrastructure investment based on the value creation possibilities open to the various industries. One thing that is being widely asked for is the possibility of providing for increased integration and cooperation with Norway's neighbours in the Cap of the North and the Barents region through infrastructure measures.

6.1.5 Limited access to capital and fragmented ownership

There are large differences between the different industries looked at in the knowledge-gathering project in terms of how capital intensive they are and the extent to which they have problems raising sufficient capital. Generally speaking, while offshore and housing-related investments have had good access to investment-ready capital in recent years, traditional industry, technology enterprises and innovative start-ups in particular have had more trouble raising capital. One good example of innovative start-ups is the biomarine business cluster in Tromsø, which is not just very competence intensive, but capital intensive too. It requires capital that is willing both to take risks and to wait a long time for a possible return.

Business in Northern Norway is characterised by small private owners to a greater degree than the rest of the country, while foreign ownership is just a third of the level in the rest of Norway. This can be a strength, because local and regional ownership provides regional control, independent decision-making and regional investment competence. On the other hand, a large number of small, personally owned enterprises can mean that business has limited resources for investment, product development and market development. For example, tourism in Northern Norway has a much more fragmented infrastructure, with few large players, than tourism in the rest of Norway. In this context it is important to balance the objectives of regional control with the possibility of opening the way for more national and international ownership with the opportunities this brings in terms of access to both key resources and networks that can provide useful market competence.

The commonest, and therefore the most important, source of capital is loan financing. The role of the banks in channelling capital is therefore important for access to capital, and in order to perform this role well, the banks must be familiar with business in the area and have top expertise with regard to relevant investment objects. Northern Norway is a region with an industrial structure quite different from that in the rest of the country, and

the fact that the finance industry has been characterised by an increasing degree of centralisation of the banking sector, resulting in a smaller local presence than before, may be a challenge from this perspective.

6.1.6 Area use conflicts

Access to suitable areas is a challenge for several of the industries looked at in the knowledge-gathering project. Fisheries, aquaculture, the mineral industry, renewable energy, tourism and the petroleum industry are all area-intensive users of the coastal zone. Although Northern Norway is sprawling in a geographical sense, it has several interest groups that are probably competing for area. One dividing line seems to run between industries that are largely based on exploiting resources, such as fish and nature in the case of tourism, and more industrial development involving petroleum, renewable energy and mineral operations.

In the case of the renewable energy and mineral sectors area challenges represent a major limitation. It will become more and more challenging to find suitable areas where activities will not come into conflict with other industries, such as tourism, reindeer husbandry and fisheries, or other interests, such as nature conservation and outdoor life. According to the sectoral analysis for renewable energy, a growing proportion of licence applications are being rejected because of potential area conflicts, for example.

Sami industries have to be looked after separately under legislation and international obligations, and are assigned a central role in planning processes and consequence analyses for new development. Traditional Sami industrial interests have limited resources for taking part in and influencing such processes, however, and come up against well-financed interests that can provide new jobs with high value creation.

There can also be conflicts of interest between local, regional and national levels. For example, little of the coastal area within the baseline is used for aquaculture, an industry with great growth potential that can produce local ripple effects in the form of employ-

ment. In this case it is not necessarily local area conflicts that are the obstacle, but national frameworks that impose restrictions based on the overall problems of escape and the spread of salmon lice.

Vista Analyse et al. (2013) takes a close look at possible conflicts between the interests of different industries or other user groups in a number of example studies. One of the example studies looks at the possible consequences of mining in Kvalsund. Mining would generate substantial economic value creation and local ripple effects, but would also have a negative impact on important ecosystems as a result of waste dumping. A land dump would be in an important area of reindeer pasture, while a sea dump would have to be located in a national salmon fjord. The community would have to try and offset the quantified earnings and ripple effects from possible mining against the negative, and generally unquantified, impact on ecosystem services. A possible strategy could be to defer the decision with a view to gathering more knowledge, but this would also entail cost. The example studies discussed in Vista Analyse et al. (2013) show that balancing different players' use of areas, resources and ecosystem services is a fundamental challenge when it comes to providing a framework for increased value creation in the sectors looked at in knowledge-gathering project.

6.2 Policy instruments to meet the challenges

The overall objective of *Knowledge Gathering – Value-Creation in the North* is to investigate how Norway and Northern Norway can prioritise increased value creation in Northern Norway, and what the effects and ripple effects of this might be for community life in Northern Norway. We have now looked at some of the key challenges that are faced by business in Northern Norway and prevent the potential for value creation in the region from being exploited to the full. This section takes an in-depth look at the most appropriate policy instruments for meeting and tackling those challenges with a view to realising more of Northern Norway's value creation potential. Unless specified otherwise, the section is based on the report *Virkemidler for økt verdiskaping i Nord-Norge* (NIBR, 2014).

6.2.1 What are policy instruments?

The authorities use various policy instruments to control or influence how players act in society. They are targeted at the objectives for the authorities' engagement, making them tools for achieving desired results in policy implementation. If a policy has objectives, instruments are also needed in order to achieve them. Therefore, policy instruments always have to be adapted to the context in which they are to work – they have to be targeted. They can be new or consist of changes/twists or stronger prioritisations within the policy instruments already being used. They should be as cost-efficient (i.e. achieve the objective at the lowest possible cost) and effective (i.e. contribute to the objective actually being achieved) as possible and have low administration costs. In addition, the schemes should be clearly organised and easy to understand, as well as being perceived as fair.³

6.2.2 Types of policy instrument and responsibility

Central government is responsible for much of policy instrument use in Norway, but has delegated some of the responsibility to the counties, municipalities and various government agencies. Delegation follows the principle of subsidiarity, which means that responsibility should be placed as close to the user as possible. The fact that responsibility is dispersed means that policy instrument use is not necessarily integrated and coordinated, and that there is potential for conflict between different prioritisations on the part of different administrative levels. Such conflicts can relate to both objectives and use of policy instruments. Generally speaking, increased regionalisation will make it possible to adapt policy instrument use more to regional needs, potentially enhancing the value creation effects of policy instrument use. A more centralised system offers less scope for exploiting regional advantages, but opportunities to follow national principles, including the principle of equality.

In interviews with the three northernmost counties, the Norwegian Institute for Urban and Regional Research

³ See NIBR (2014) for a more detailed account and discussion of the theory of policy instrument use

(NIBR) finds that the counties do not necessarily want new policy instruments, but predictability, with the guidelines for policy instruments and policy for the region remaining fixed over time. They also ask for real scope for action in stimulating development in local areas based on what they see as the areas' possibilities for industrial growth. This is particularly relevant with a view to implementing long-term prioritisations, but also in terms of ensuring the right capacity and competence in the regional policy instrument apparatus.

NIBR (2014) provides a brief overview of policy instruments and players.⁴ It puts the policy instruments in three categories: legal, economic and informative.

Legal policy instruments

Legal policy instruments include statutes, regulations, guidelines and the duty to consult. This covers everything from the Constitution to legislation for different business types, as well as various EU directives and other international obligations. Legal policy instruments provide a framework for what can be done and the effects that can be achieved.

Statutes of particular relevance when it comes to nature-based value creation in Northern Norway include the Planning and Building Act, the Minerals Act, the Finnmark Act, the Reindeer Husbandry Act and the Pollution Control Act. Several of these statutes impose requirements with regard to analyses and set out an objection process. There are, in addition, a number of other statutes and regulations targeted at different sectors that can have a major impact on development in the region, with fisheries being a good example.

Article 110a of the Constitution of the Kingdom of Norway – the Sami Article – says that conditions must be created enabling the Sami people to preserve and develop its language, culture and way of life. Norway has also signed international conventions committing it to protecting the interests of the Sami as an indigenous people, including the ILO Convention and the

⁴ See also Appendix 2 for an overview of all the policy instruments discussed in the knowledge-gathering project's sectoral and cross-sectoral analyses.

UN Covenant on Civil and Political Rights. The duty to consult was introduced in 2005 and is intended to ensure that the Sami Parliament of Norway is consulted on matters of importance to the Sami community, including matters to do with value creation and business development in Sami areas.

Economic policy instruments

Economic policy instruments are taxes, duties, grants and subsidies of various kinds, which seek to influence the use of selected services and products by altering their price.⁵ Some of them are fiscal in that they are (only) intended to generate revenue for the state, with changes in the use of services and products being largely an inadvertent effect. Our primary interest here, however, is in policy instruments that are designed to influence players in a desired direction. Economic policy instruments, including those that are national and general, will affect different industries and regions differently according to how much they use the goods that become either more expensive or cheaper.

Many of the economic policy instruments are adopted and administered at central government level, but many of those intended to stimulate business development are also delegated to regional level. Economic policy instruments can also be drawn up at regional and local level, such as different types of stimulant for business in the area for which there are no central government guidelines. EEA rules place a good many restrictions on the use of grants and subsidies, however.

One important policy instrument is regionally differentiated social security contributions (DA), a geographically based exemption scheme. Its purpose is to reduce the cost of labour for enterprises located outside central areas by their paying lower social security contributions than enterprises in central areas. When the DA scheme was introduced in 2007, after being prohibited under the EEA Agreement for a time, social security contributions in Tromsø and Bodø were raised slightly, with the additional costs incurred

⁵ "Services and products" also include use of ecosystem services and the environment. One example of this is the CO₂ tax.

by business as a result going to the county councils. The money was spent on joint measures (e.g. expansion of broadband) and development projects.

Grants are made to the county council for regional development and compensation for social security contributions through the Ministry of Local Government and Modernisation's budget. The county councils spend some of this money on Tools for Regional Development (RUP), the purpose of which is boost value creation in business environments and develop attractive jobs by promoting innovation, change and start-ups. Tools for Regional Development are traditionally the main component in a county council's action programme.

The Sami Parliament of Norway also awards grants for business-oriented measures and various cultural measures. The grants are usually targeted at small-scale activity in primary industry, language and culture.

Innovation Norway (IN), the Research Council of Norway and SIVA – The Industrial Development Corporation of Norway administer both national and regional policy instruments. Over time, these players have built up key competence in the implementation and evaluation of policy instruments and programmes. IN administers a number of different policy instruments aimed at business development and value creation. They include loans and grants of various sorts, such as innovation loans, low-risk loans, start-up grants, and grants for R&D and different types of plant. IN also administers the venture and seedcorn fund scheme. The Research Council of Norway (NFR) plays an important role in policy instrument use through various research programmes, for example. The Programme for Regional R&D and Innovation (VRI) aims to promote knowledge development, innovation and value creation through regional cooperation, especially between enterprises and R&D institutions. The Arena Programme, which is owned by Innovation Norway, SIVA and the Research Council of Norway, is a cluster development programme offering financial and professional support for long-term development

of regional business environments. The Research Council of Norway also administers SkatteFUNN⁶, which offers tax deductions for R&D costs.

Informative policy instruments

Information, advice, guidance and training are policy instruments that are often used alongside economic or legal policy instruments. Guidance is provided by several levels of government, with regional and local levels being particularly active when it comes to guiding businesspeople and entrepreneurs, or helping to build up networks between them. Advice and training are an important part of public provision.

6.3 Policy instruments and value creation

The purpose of the policy instruments discussed in the knowledge-gathering project is to increase value creation in the sectors focused on. The knowledge-gathering project is also intended to investigate the effects and ripple effects these policy instruments, i.e. prioritisations, will have on communities in Northern Norway. According to NIBR (2014), it is by no means automatic that policy instruments that contribute to the efficient use of resources and increased value creation will also contribute to positive effects and ripple effects for communities in Northern Norway. Policy instruments aimed at increasing value creation based on natural resources in the region will not necessarily have a major impact on employment. Increased revenue in industry based on natural resources will contribute to increased earnings in the region, however. These earnings will be spent, at least in part (people mainly spend their pay where they live), in the region. Seen in this light, increased value creation in the basic industries will contribute to ripple effects in the private and public service sectors, and therefore to increased production, value creation and employment there. Many of the value creation effects, especially in the case of employment perhaps, could therefore occur outside the resource-based industries.

⁶ SkatteFUNN is a tax incentive scheme. All Norwegian enterprises with research and/or development projects (R&D projects) can apply for SkatteFUNN approval to enable them to make use of their tax deduction entitlements. SkatteFUNN is administered jointly by the Research Council of Norway, Innovation Norway and the Norwegian Tax Administration.

NIBR (2014) links policy instrument use to the general challenges facing industries in Northern Norway: labour as a limited resource, low competence and educational levels, limited research and innovation, limitations in infrastructure, limitations in access to capital and fragmented ownership structure, and area use conflicts. As these challenges are the most important, the policy instruments employed should target each individual challenge as directly as possible.

Given that the objective is to increase value creation, there are several ways of conducting business-oriented policy. Firstly, an *area-oriented* policy can be chosen, that is to say a policy targeted exclusively at value-creation in Northern Norway. Secondly, it is possible to opt for an *industry-oriented* policy aimed at the industrial sectors that are overrepresented in Northern Norway, or industries that are considered to have good future prospects in the region. The third option is to look at policy instruments that have a more indirect impact on value creation in the region. This category includes *people-oriented* policy instruments, which are targeted at local development and the labour market. Fourthly, it is conceivable that a combination of the three aforementioned categories could be chosen. In the following we examine the possible effects of policy instruments aimed at overcoming the general challenges identified in the knowledge-gathering project. We also look at the effects of selected industry-oriented policy instruments, and the effects of combining several types of policy instrument in so-called packages.

For some of the policy instruments in question, effects on value creation and employment were calculated using the NOREG economic model, which was developed as part of the knowledge-gathering project; see Box 6.1 for a brief introduction to the model, and Appendix 4 for a description of the model and what is called the reference scenario. The reference scenario is the development expected in the economy without any change in framework conditions, which in principle is the same as the projection of the Norwegian economy in the Ministry of Finance's most recent

BOX 6.1 NOREG – a regional economy macromodel

A socioeconomic model is required in order to carry out consistent calculations for future value creation and regional employment. There are a number of economic models that can be used for this purpose, but none that both takes account of the geographical dimension in the ripple effect models (effects at county or municipality level) and the equilibrium effects in the national macromodels, i.e. it is not possible to use more resources than are available. Work was therefore started on the development of such a model that would allow for real restrictions in the economy and the geographical dimension. The model, christened NOREG, is documented in Bruvoll et al. (2014).

The NOREG model is a regional model for Norway with a national macroeconomic superstructure. The national module takes account of the general equilibrium mechanisms between industries and over time, while the regional module describes how production of goods and services is spread across the country over time. The macromodel is a standard applied general equilibrium model in which the underlying growth factors are access to labour, access to capital and technological change. Based on estimates for these factors, the economy grows by the production industries obtaining increased access to the primary input factors.

In the regional module, development in the national economy is spread across all the counties in the country, taking account of where in the country the economic change (or policy measure) occurs, and of distances between counties and cumulative effects. In this way the model allows for both the country's geography (distances) and the regions' degree of centralisation (accumulation of economic activity).

The simulations using the model are carried out by calculating the macroeconomic effects of various policies (policy instrument use) or other events up to 2060. Then the regional effects are calculated based on the changes nationally.

"Long-term Perspectives on the Norwegian Economy" (Meld. St. nr 12, 2012-2013). Annual growth in the reference scenario for the industries used by NOREG is presented in Table 6.2. All the effects calculated are presented in the form of percentage deviations from the reference scenario. The effects of policy instruments that are unsuited to calculation in an economic

TABLE 6.1
Development in the individual industries in the reference scenario, annual growth.

	FISHING	AQUA-CULTURE	TOURISM	RENEW-ABLE ENERGY	MINERAL INDUSTRY	OIL & GAS	OTHER INDUSTRY	BUILDING & CONSTRUCTION	INFRA-STRUCTURE	PRIVATE SERVICES	PUBLIC SERVICES
2010-2020	4.3%	1.9%	5.5%	4.3%	1.1%	-0.8%	2.7%	0.1%	3.3%	3.0%	2.3%
2020-2030	3.5%	1.6%	4.9%	3.3 %	2.2%	-1.9%	2.7%	1.2%	2.7%	2.7%	2.0%
2030-2060	1.6%	1.2%	4.9%	3.2%	-0.7%	-3.7%	0.6%	2.1%	2.0%	2.5%	1.8%
2010-2060	2.5%	1.4 %	5.0%	3.4%	0.2%	-2.8%	1.5%	1.5%	2.4%	2.6%	2. %

Source: Menon/Vista Analyse

model are discussed qualitatively. Unless specified otherwise, the assessment of the policy instruments and the effect they may have on value creation is based on NIBR (2014) and Bruvoll et al. (2014).

6.3.1 Sector-specific policy instruments

There are a large number of policy instruments that can be used to stimulate a single industry or sector; see Appendix 2 for an overview of the policy instruments discussed in the sectoral analyses, for example. It was not possible to use NOREG to look at the effects on value creation of all these policy instruments both for technical reasons and because of the resources that would have been required. Instead, we selected some policy instruments to illustrate the effects that sector-specific prioritisations can have.

The aquaculture, renewable energy and mineral industries are all subject to the same requirement that the quantity of resources they can exploit is controlled by concessions and licences. In the case of these industries it is therefore possible to increase value creation by granting more concessions, provided that operations are conducted in a sustainable manner, of

course. In the following we look at what this can mean for value creation in the industries in question, the entire region and Norway as a whole. We also look at some policy instruments or measures that are specifically aimed at tourism, which is a key industry in the knowledge-gathering project.

Increased growth in aquaculture

In the short and medium term, policy definition with regard to licensing and maximum permitted biomass in the sea for each licence (MPB), for example, will be key to growth and its distribution in the aquaculture industry. In the slightly longer term, growth will be determined by the market, area availability, access to feed resources and technological development.

The sectoral analysis for aquaculture presents a reference alternative for development and two impact alternatives ("full implementation" 1 and 2), see Winther et al. (2013) and Appendix 3. NOREG was used to perform an impact calculation for the first alternative, which gives growth in value creation in the industry in Northern Norway of around 7% per annum in the period 2012-2030. Such growth

TABLE 6.2

Effects of the sector-specific prioritisations on value creation (GRP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

PRIORITISATION OF	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Aquaculture								
Value creation in the industry	100.60%	467.80%	100.60%	467.80%	100.60%	467.80%		
Value creation in the county	2.90%	10.50%	1.90%	6.60%	2.40%	7.90%	0.20%	0.70%
Employment in the county	0.30%	1.10%	-0.1%	-1.10%	-0.1%	-0.6%	0.00%	0.00%
Tourism								
Value creation in the industry	10.6%	3.9%	4.5%	1.7%	3.9%	1.4%		
Value creation in the county	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Employment in the county	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.00%	0.00%
Minerals								
Value creation in the industry	74.80%	144.90%	53.90%	102.90%	75.20%	145.70%		
Value creation in the county	0.70%	0.70%	0.10%	0.10%	1.00%	1.00%	0.00%	0.10%
Employment in the county	-0.10%	-0.20%	0.00%	0.00%	-0.40%	-0.40%	0.00%	0.00%
Renewable energy								
Value creation in the industry	8.80%	22.70%	8.80%	22.70%	8.80%	22.70%		
Value creation in the county	0.80%	2.90%	0.20%	0.80%	0.60%	2.10%	0.00%	0.10%
Employment in the county	0.0%	0.2%	0.0%	0.0%	0.0%	0.1%	0.00%	0.00%

Source: Menon/Vista Analyse

assumes among other things, that new area is taken into use, i.e. an increase in the number of licences), that national growth in aquaculture is the same as assumed global growth (4.2% per annum), and that Northern Norway accounts for a larger proportion of the growth than the rest of the country, enabling it to increase its share of national production from a good 40% in 2010 to 60% in 2030. Growth after 2030 is as in the reference scenario for the whole country.

Putting these conditions in place for the industry would mean that value creation in the industry would be twice as high in 2030 as would have been the case if current development continued (i.e. 100% higher than in the reference scenario), and more than five times higher in 2060.

As Table 6.2 shows, this policy produces not inconsiderable growth in total value creation in the three northernmost counties of 2-3% in 2030 and 6-10% in 2060, but not compared with value creation in the aquaculture industry. This means that a strong brake is being applied to total value creation as a result of the aquaculture industry feeding on the activity of other industries, i.e. there is a large displacement effect. Value creation in other industries would fall by 3-4% compared with the reference scenario in 2060.

The measure does not have an impact on employment nationally, but paradoxically it produces a decline in employment in Troms and Finnmark. This is because the not very labour-intensive aquaculture industry would take resources (i.e. the input factors capital and labour) away from more labour-intensive industries.

Increased prioritisation of tourism

As discussed in Chapter 4, Northern Norway should have good prerequisites for attracting some of the expected growth in international tourism. The sectoral report on tourism presents a number of measures that might be supposed to stimulate activity in the tourism industry in Northern Norway in the years up to 2030, 2050 and 2100 (Enger et al., 2013a). Many of these measures are difficult to model within the framework

on which NOREG is based because the proposals are more qualitative in nature and do not include specified costs and expected earnings. It was possible to model the effects of two major measures, however.

- *Destination development and charter fund*, in which current funding for tourism in Northern Norway is trebled and charter tourism is prioritised. The charter fund aims to reduce risk for operators who want to set up routes to Northern Norway, and it is assumed that the fund guarantees 20% of the seats on the 500 charter flights assumed to land in Northern Norway in 2020. It is estimated that these measures would cost approximately NOK 100 million per annum.

TABLE 6.3
Investment and operating expenses for measures in the tourism industry for selected years, and expected export earnings. NOK millions.

	2016	2021	2030	2060
Investments				
Destination development and charter fund	99.5	109.9	131.3	237.8
Airport expansions	800	0	0	0
Total	899.5	109.9	131.3	237.8
Export earnings				
Destination development and charter fund	415.3	458.6	548	992.7
Airport expansions	0	220.3	263.3	476.9
Total	415.3	678.9	811.3	1469.6

Source: Menon/Vista Analyse

- *Airport expansions*, with new airports at Gimsøy in Lofoten and Mo i Rana in Helgeland. This is expected to cost a total of NOK 4 billion during the period 2016-2020 based on figures quoted in the national transport plan and Avinor's estimates. It is anticipated that this would give rise to growth of 180,000 hotel visitor nights in Lofoten and 100,000 in Helgeland.

Table 6.3 totals up the size of the investments in destination development, the charter fund and airport expansions, and what it is assumed this would generate by way of effects in the form of increased exports (earnings from foreign travellers).

Such prioritisation of the tourism industry helps to increase the industry's value creation in the counties by 4-10% in 2030 and 1.4-4% in 2060 compared with the growth in the reference scenario, see Table 6.2. It should be pointed out, however, that the tourism industry is already assumed to have annual growth of 5% in the reference scenario and is the industry with the strongest annual growth (see also Table 6.1). But the increase in GDP in the counties of Northern Norway and in Norway as a whole would be quite marginal. This is because the prioritisation of tourism produces large displacement effects, with up to 95% of the gain in the form of increased value creation in tourism being eaten up as a result of activity in other industries being displaced, both nationally and regionally. This severe displacement effect is probably due to the fact that the industry is relatively labour-intensive and so takes labour from other sectors.

Increased expansion of renewable energy

The sectoral analysis for renewable energy projects two alternatives, a base scenario (current framework conditions) and a high scenario (full implementation), see Analyse & Strategi et al. (2013) and the description of future possibilities in Chapter 4. The NOREG simulation of growth in renewable energy takes the high scenario as a basis, with value creation nearly doubling from 2011 to 2030 (NOK 6 and 11 million respectively), and doubling again by 2050 (NOK 20 billion).

The effect is marginal growth in value creation in Northern Norway in the years to 2030 compared with the reference scenario, but somewhat larger growth in the longer term, see Table 6.2. Here too nearly 90% of the increase in value creation in the renewable energy industry is eaten up by a displacement effect. The analysis of this industry has to be seen in light of the fact that the reference scenario already assumes strong growth in the industry, see Table 6.1. The industry's importance for the region will therefore increase over time regardless. If the industry manages to grow even more, it will necessarily be at the expense of activity in other industries.

Increased extraction of minerals

The sectoral analysis for the mineral industry contains projections of ore and industrial mineral resources, see Vista Analyse and Sweco (2013). The reference alternative is defined as a continuation of production based on current deposits up to 2030 and 2050 based on the Geological Survey of Norway's data, and it is assumed that existing operations will double turnover and value creation in 2030 compared with 2011 and remain unchanged up to 2050. A maximum alternative equivalent to the reference alternative plus what it would be possible to develop in the years to 2030 and 2050 with new and/or enhanced policy instruments was also defined. The NOREG simulation used a gross product scenario that is halfway between the maximum alternative and the reference alternative in Vista Analyse and Sweco (2013).

The mineral industry is very small in national terms. To all intents and purposes this means that the impact of increasing production in the industry on GDP at both county and national level will be small, see Table 6.2. As with the other industries, prioritisation of the mineral industry produces a displacement effect, with more labour-intensive industries being drained of resources, as a result of which employment in Nordland and Finnmark falls slightly.

6.3.2 Increased access to labour

Because obtaining sufficient labour for the region is such a challenge, people-oriented policy instruments may be just as important for value creation in Northern Norway as industry-oriented or sector-specific policy instruments. People-oriented policy instruments aim to strengthen population development by limiting emigration and/or increasing immigration to the region by making the region a more attractive place to live. Access to labour can also be increased by improving the labour market participation rate among the region's inhabitants.

People-oriented measures are about providing incentives for the population in Northern Norway to grow. This can involve purely financial incentives (measures that raise income and reduce expenses), other labour market measures and measures to increase local attractiveness in a broader sense.

Income-raising measures can consist of tax relief or pay subsidies, either directly for employees or through employers. Such policy instruments will increase income without enterprises' costs going up, keeping enterprises competitive. The current differentiated social security contributions scheme is an example of this type of income-raising measure. In addition, employers themselves can choose to increase pay in order to attract workers. There are examples of enterprises in Northern Norway that are short of labour already doing just that.

Expense reduction measures are material measures that make it cheaper, relatively speaking, and therefore more attractive to live in Northern Norway compared with the rest of the country. Student loan rebates in the Action Zone in Nord-Troms and Finnmark are one example of such measures.

The attractiveness of local communities is of great importance in terms of where people want to live, and measures to enhance that attractiveness might therefore help to recruit more inhabitants and enlarge the labour force. A number of different factors and combinations of factors make people want to live somewhere or move there. Prioritisation of local attractiveness

might include everything from culture-based local and business development, inclusion of incomers, image building, providing a framework for creating more varied jobs in small towns, varied housing provision, and new solutions for important service functions.

Good service provision is important when it comes to recruiting inhabitants. NIBR (2014) points to special challenges for welfare production in rural municipalities, where a small market for private services gives the municipalities more to do, while tax revenue in Northern Norway's municipalities is consistently worse than in the rest of the country. The municipalities in Northern Norway are currently compensated for this through the General Purpose Grant Scheme.

Access to labour can also be increased by improving the labour market participation rate in the region. This can be done by increasing the employment rate in the population as a whole or among those with the lowest employment rate at present (in other words the 'tail ends' in the age distribution, people with disabilities and people on benefits or women). Relevant measures can make it more attractive to work and less attractive to be excluded from the labour market, or make it possible for disadvantaged groups to find work. Such measures would have to be implemented nationally and would have an impact throughout the country, not just in Northern Norway.

The individual measures for increasing access to labour cannot be modelled in NOREG, but it is possible to calculate what increased immigration might mean for value creation in the region, i.e. how big the impact of managing to make it attractive to remain or settle in Northern Norway will be. It is also assumed that better provision will be made for increased labour immigration. Statistics Norway's alternative with high immigration is used instead of its middle alternative for population growth, while the proportion of the labour force with higher education is assumed to remain unchanged (i.e. immigrants are assumed to have the same distribution of people with lower and higher education as the rest of the popula-

TABLE 6.4

Effects of increased immigration on value creation (GRP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Increase in GRP / GDP	2.7%	9.6%	3.0%	12.7%	2.5%	10.2%	3.0%	13.1%
Increase in employment	5.4%	23.2%	5.2%	23.5%	5.1%	23.3%	5.9%	25.6%
Increase in proportion with higher education	0.0%	-0.1%	0.0%	-0.2%	0.0%	-0.2%	0.0%	0.0%

Source: Menon/Vista Analyse

tion). Increased immigration can help to increase the number of employees by 6% in 2030 and more than 25% in 2060 compared with the reference scenario, not inconsiderable growth, especially in the slightly longer term, see Table 6.4.

Immigration has a major impact on value creation in both Northern Norway and Norway as a whole, because more productive resources are brought into play. It is the labour-intensive industries in particular that see strong growth, as they will have a larger supply of their most important input factor. This makes it cheaper, relatively speaking, to produce goods and services in these industries, which is particularly relevant for the tourism industry, infrastructure (transport), and private and public services. These industries are important in Troms, so it is natural that the impact on total value creation should be greatest in that county.

6.3.3 Increased prioritisation of competence and education

If, like Damvad et al. (2013), we assume that productivity increases with competence, competence-raising measures targeted at the available labour force in Northern Norway would help to increase productivity,

and with it value creation, in Northern Norway. Such measures can be introduced in a number of areas and at different educational levels.

NIBR (2014) identifies measures that increase the probability of pupils who embark on upper secondary education completing the course. This can be achieved by means of measures that make education more attractive for pupils (education measures) or measures targeted at pupils (pupil measures). Adapting curriculums may be one education measure that could give more pupils the opportunity to have a more practical education than is currently the case, making it more attractive. Adapting curriculums and increasing vocational course provision may also help to increase the number of school leavers with vocational qualifications. Education provision in the region can be adapted more to the needs of trade and industry, with the result that the supply of labour with vocational qualifications will be better adapted to demand in the labour market.

Informal competence can be defined as the competence acquired outside formal educational institutions. Enterprises in the private and public sector should be given framework conditions that make it profitable for

TABLE 6.5
Effects of raising educational level on value creation (GDP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Increase in GRP / GDP	7.0%	6.4%	7.4%	6.8%	6.8%	6.1%	2.4%	2.5%
Increase in employment	14.7%	11.6%	14.5%	11.2%	14.8%	11.2%	5.2%	4.2%
Increase in proportion with higher education	39.9%	31.4%	39.5%	30.9%	40.4%	31.8%	15.8%	12.1%

Source: Menon/Vista Analyse

them to contribute to increasing employee competence. This could be done using grant schemes or tax relief, for example. Such measures can be said to be formal in the sense that it has to be possible to document them with course certificates, etc.

A general improvement in educational level can be achieved by increasing access to student places. It is by no means certain, however, that more student places in Northern Norway would increase the educational level in the region. Figures from Statistics Norway show that between 2000 and the present there was no clear correlation between development in regional distribution of the number of student places, the number of students domiciled in the region and the educational level in the region. According to NIBR (2014), however, some students are recruited regionally and the location of institutions of higher education has a positive impact on regional development, while education is an important motive for moving. NIBR (2014) is therefore of the opinion that increasing education capacity in the region may help to increase productivity, and with it value creation, in Northern Norway. If the expansion of education capacity is tailored to the needs of business and the public sector,

productivity will probably grow faster than if the educational level is raised more generally.

NOREG was used to calculate the impact of enhancing educational level, with the proportion of the labour force with high education gradually increasing to 60% in 2030 and then holding steady. NOREG operates with two types of labour, people with low education, who are educated up to and including upper secondary school, and people with high education, who are educated to university/college level. Productivity, and therefore pay, is higher for labour with high education.

The cost of such measures has been calculated at NOK 6 billion per annum.⁷ It is assumed that Northern Norway will have to bear a larger share of these costs than the rest of the country in order to compensate for the educational level in Northern Norway being

⁷ This is based on a cost of NOK 750,000 per student place (NOK 150,000 per annum for five years), see the Ministry of Education and Research's accounts of standardised costs for student places in the country, and 7,500 new students a year being educated. There are approximately 60,000 births per annum, which, with an 85% labour market participation rate, means 50,000 newcomers to the labour market every year. The proportion with high education in 2030 is to increase from around 45 to 60%, which will mean 7,500 more people with high education every year.

lower to begin with.⁸ The impact in the region will be considerable, with growth in value creation of 7% in 2030 and 6-7% in 2060, see Table 6.5. This prioritisation will contribute to a strong increase in employment in the region of close to 15% in 2030 and a slightly more modest increase in relation to the reference scenario in 2060.

The prioritisation of education in NOREG produces a national increase in the proportion of people with higher education of around 16% in 2030 and 12% in 2060, see Table 6.5. The effect is much greater in Northern Norway, and with this comprehensive prioritisation around 80% of employees in Northern Norway would have higher education in 2060.

6.3.4 Increased prioritisation of research and innovation

According to Damvad et al. (2013), conducting innovation activity in small enterprises and business environments is a challenge, so cooperation on innovation would be of definite value for business in Northern Norway. Close contact with others through innovation networks, for example, generates ideas and economies of scale in the form of joint knowledge development on challenges and understanding surroundings, driving forces and barriers. The development of knowledge networks in order to strengthen prioritisation of R&D and so increase value creation is a policy instrument covered by several of the sectoral analyses. According to NIBR (2014), the authorities should provide a framework for such cooperation initiatives by contributing to funding and forums through SIVA or Innovation Norway, for example.

In the report *SMART 4H, Forslag til Smart Spesialisering for Nordland* (Mariussen et al., 2013) the Nordland Research Institute described a proposal for what is called "Smart specialisation", which aims to improve cooperation between business, R&D environments and the authorities/policy instrument apparatus, with regional condi-

⁸ A total of 30% of the expenses will be borne by Northern Norway and 70% by the rest of Norway, whereas distribution based on the number of young people (i.e. even distribution throughout the country) would result in a much lower proportion for Northern Norway.

tions for innovation controlling strategies and priorities. This is done by strengthening the links between strong business clusters with export potential, R&D institutions and subcontractors in the region.

Business-oriented research and development in the individual institution can be developed in cooperation between research institutions and business. In this way different forms of *applied research* can be made relatively targeted. Use of policy instruments by the authorities within applied research is linked to base grants for the individual research institute or university/college, but also to research programmes at the Research Council of Norway, research programmes under the auspices of various authorities, or more ordinary procurement of research and analysis services. The return on resource use in research is uncertain by its very nature. This is an argument in favour of the authorities funding some of the research even if it is business-oriented, or setting up insurance schemes that reduce the risk involved in the individual project.

The calculation of the impact of increased prioritisation of R&D using NOREG was based on the government's target that 3% of GDP should be spent on R&D in 2030, i.e. nearly twice the current spend. In the simulation, public expenditure on R&D is increased by 1.5% of GDP, with a real return that corresponds to what is achieved in the SkatteFUNN tax deduction scheme, namely 8% (Cappelen et al., 2008). It is assumed that 30% of the increased R&D costs will be borne by Northern Norway, in other words targeted at R&D jobs in Northern Norway.

The effects in Northern Norway will be relatively large in the long term. Value creation increases by around 3% in 2030 and 5% in 2060, see Table 6.6. The impact is much greater than for the country as a whole, which indicates that much of the increase in value creation is due to the costs and jobs being located in the region. The effects of increased R&D are fairly similar for the three counties in consequence of the prioritisation being distributed on the basis of each county's share of value creation in the base year. If the R&D activity

TABLE 6.6
Effects of an increase in R&D expenditure on value creation (GDP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Increase in GRP / GDP	3.0%	5.1%	2.8%	5.2%	3.2%	5.3%	0.3%	1.2%
Increase in employment	1.6%	1.2%	1.2%	1.0%	1.5%	1.1%	0.0%	0.0%
Increase in proportion with higher education	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.0%	0.0%

Source: Menon/Vista Analyse

TABLE 6.7
Effects of simultaneously boosting education and R&D on value creation (GDP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Increase in GRP / GDP	10.4%	12.0%	10.6%	12.7%	10.4%	11.9%	2.9%	4.0%
Increase in employment	16.3%	12.8%	15.8%	12.2%	16.4%	12.4%	5.2%	4.2%
Increase in proportion with higher education	39.8%	31.4%	39.4%	30.8%	40.2%	31.7%	15.8%	12.1%

Source: Menon/Vista Analyse

had been distributed on the basis of current R&D intensity in the counties, Troms would have had a much bigger increase in value creation and employment. The increased R&D activity boosts employment by 1-2% compared with the reference scenario in 2030 and 2060, and because this measure is largely about increased use of resources in public services, we

see a slight increase in the proportion of people with higher education in the region.

Another simulation was done in NOREG in which the two prioritisations of education and R&D respectively were combined. The prioritisations are additive and distinctly so, with the combined effect actually being

slightly higher than the sum of the two, see Table 6.7. These prioritisations thus appear to be mutually reinforcing.

6.3.5 Increased prioritisation of infrastructure

Greater prioritisation of infrastructure will mean investing in the improvement and renewal of infrastructure, while earmarking funds for operation and maintenance. Generally speaking, infrastructure measures have three main effects on the economy. Firstly, such measures lead to increased activity in the economy as a result of increased resource use for infrastructure. Depending on the capacity in the economy, this will lead either to the displacement of other activity (in the case of full capacity utilisation) or capacity and employment increasing (in the case of unemployment for example). Secondly, infrastructure measures lead to lower transport costs by cutting distances. This provides better market access for enterprises located in Northern Norway. The distances within the region become shorter too, which can help to enlarge the labour market regions. Thirdly, such enlargement of the labour market regions can contribute to further productivity effects as a result of better matching between labour and relevant enterprises, the faster, more comprehensive exchange of competence, and sharing/market enlargement. See also Vista Analyse (2014) for a more detailed description of these effects.

There are a number of transport infrastructure measures that could boost value creation in Northern Norway in this way. In particular, Hanssen et al. (2013) identifies improvements linked to the road network, ports, railways and airport structure.

- As far as the *road network* is concerned, the priority must be improvements that increase the predictability of transport, and the implementation of maintenance measures with a view to clearing the considerable backlog that has built up on both national and county roads. The E6, the roads connecting Norway and Sweden, and several of the ferry links are especially important.
- As regards the *ports*, it is important to develop the node function of the trunk network ports in the region, especially of those ports with rail links, making intermodal transport corridors possible. This will be an important measure in terms of establishing more sustainable transport solutions.
- When it comes to the *railways*, the capacity of the Ofoten Line should be increased, while the quality of the Nordland Line should be improved by introducing remote traffic management and generally upgrading the track.
- With regard to *airport structure*, the establishment of larger airports in Helgeland and Lofoten will be a key factor in enabling business in these areas to increase value creation. Hammerfest also needs a larger airport owing to the considerable potential for value creation offered by petroleum production in the Barents Sea.

According to Analyse & Strategi et al. (2013), grid capacity in Northern Norway places major restrictions on value creation in the renewables sector. It identifies several measures that could increase value creation, especially with regard to expanding grid capacity. Greater reliability of supply would provide a better basis for setting up other business in parts of the region where the power supply is currently too unreliable. Tailoring the grid more to power producers' needs could pave the way for power generation in areas that do not currently have the grid capacity to carry additional production. Export capacity can also be increased in order to provide scope for increased overall production of renewable energy in the region.⁹

⁹ According to Analyse & Strategi et al. (2013), an alternative to exporting power would be to use strategic business development to develop industries that create value through local use of renewable energy resources. This will require good framework conditions for power-intensive industry, for example, to be established at national level, while at regional level strategic business plans should be drawn up with a view to providing a framework for increased overall value creation based on local energy/labour resources and the raw materials available locally. Modern technology opens up several possibilities in this respect, such as locating large server parks, which require a lot of energy, in the region.

TABLE 6.8
Effects of increased investments in infrastructure in Northern Norway on value creation (GDP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Increase in GRP / GDP	3.0%	4.4%	2.4%	4.1%	3.1%	4.7%	0.1%	0.3%
Increase in employment	0.1%	-0.4%	0.1%	-0.1%	0.1%	-0.1%	0.0%	0.0%
Increase in proportion with higher education	0.0%	-0.1%	0.0%	-0.1%	0.0%	-0.1%	0.0%	0.0%

Source: Menon/Vista Analyse

To illustrate the importance of increased investment (and operation) in infrastructure measures, a calculation was carried out in NOREG, in which NOK 3 billion is invested in roads in Northern Norway, divided pro rata based on county size in terms of value creation. This calculation takes account of the first and last effect highlighted above, i.e. resource use in the infrastructure itself and the productivity effects, or wider economic impacts, generated by these investments. Productivity growth in the investment area is assumed to be around 10% per krone invested. As the investments are evenly distributed across the region, it is difficult to model reduced travelling time, so this effect has not been included.

Investing NOK 3 billion produces considerable effects in the region. Value creation is 2-3% higher in 2030, and 4-5% higher in 2060. Nationally, the impact is very small, illustrating that this investment measure is small on a national scale.

The effect on the composition of activity in Northern Norway's economy is interesting. Firstly, there is a substantial increase in value creation in the region's building and construction industry. It is this industry

that supplies most of the input for infrastructure. Value creation in the tourism industry also increases by the same amount. Suppliers of infrastructure services, on the other hand, experience a substantial decline in value creation, as cutting distances reduces the need for such services. The regional effects are governed partly by the investment itself and partly by the increased productivity in business resulting from the investments.

6.3.6 Increased access to capital

The use of policy instruments to improve access to capital for business in Northern Norway can be targeted either directly at business (known as industry-oriented investment support) or through the existing banking system. Industry-oriented investment support is currently part of Norwegian rural policy and comes in different forms, from direct support to partly subsidised loans. Enterprises' access to capital through this source is limited.

When it comes to measures that use the existing banking system, the aim must be to reduce risk for private capital so that the assessments made actually improve access to capital. It may also be the case that the potential for return and low risk is greater in North-

ern Norway than access to capital suggests, with the shortage of capital being due purely to misinformation. If so, the public effort can be as much about information on return and risk with regard to investments in Northern Norway as other forms of intervention in the market.

The authorities can also help to increase the flow of capital to business in Northern Norway more indirectly using measures such as those described above, e.g. increased prioritisation of infrastructure, education and R&D. Such measures would also help to reduce risk and increase the return on investments in Northern Norway. However, no assessments have been made of the impact that policy instruments aimed at increasing access to capital in Northern Norway might have on value creation in the three counties.

6.3.7 Policy instruments for solving area challenges

There are no simple solutions when it comes to balancing the use of areas, resources and ecosystem services by different players with a view to providing a framework for increased value creation in Northern Norway. Vista Analyse et al. (2013) attached importance to shedding light on distribution effects in its example studies, but points out that there are different ways of presenting such effects, and that different interest groups can be interested in different connections. It might, for example, be of special interest to assess the number of jobs created or lost, economic value creation and/or broad rural policy considerations for different alternatives. The results from the example studies show, however, that many conflicts can be averted or reduced by good area planning based on suitability for different uses, making it possible to achieve a good balance. Some ecosystems produce services in one place, while their benefits can be harvested in another. In this case the parties who 'own' the point of production – and get little in return – have little incentive to preserve it, while those who enjoy the benefits have little influence on its administration. According to Vista Analyse et al. (2013), this underlines the importance of not just carrying out analyses of single measures, but also looking at considerations at a more general or strategic level.

In this context it is relevant to take a closer look at how the planning institute with objection rights works when it comes to finding good solutions to area challenges and conflicts of interests. NIBR (2014) points out that regional players highlight the length of time taken by such planning processes as a problem. If planning processes take an inexpedient amount of time, it can reduce predictability and impede business development. At the same time, it is important that those affected by a measure have sufficient time to familiarise themselves with the plan, etc. Regional authorities therefore point to the need for a joint forum where the various players in the planning process can meet to present different points of view and opinions instead of the existing, more time-consuming practice, where the plan goes from body to body. There is no desire, therefore, to limit the opportunities to raise objections or present different points of view regarding a plan, but to reduce the amount of time that development plans usually take.

Several of the industries analysed in the knowledge-gathering project are area intensive, particularly aquaculture, renewable energy and the mineral industry. Solutions to the area problem will have to be found in many cases in order to realise the potential for growth in these industries.

6.3.8 Combined policy instruments

It is quite possible for public authorities to use several policy instruments at the same time in order to exploit synergy effects and stimulate increased activity in the region. At the same time, stacking several policy instruments on top of each other can create rivalry problems, as the economy has limited resources. Such effects can reduce the total impact of policy instrument use, with the effects of the measures feeding on each other.

The calculations of the effects of stimulating individual industries make it clear that these industries will grow at the expense of other industries as long as it is assumed that labour is limited and productivity of the input factors grows at the same rate as in the Ministry of Finance's reference scenario for the Norwegian

TABLE 6.9
Overview of effects of policy instrument packages targeted at Northern Norway on value creation (GRP) in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Policy targeted at one industry								
Aquaculture	2.9%	10.5%	1.9%	6.6%	2.4%	7.9%	0.2%	0.7%
Tourism	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Minerals	0.7%	0.7%	0.1%	0.1%	1.0%	1.0%	0.0%	0.1%
Renewable energy	0.8%	2.9%	0.2%	0.8%	0.6%	2.1%	0.0%	0.1%
Combination of policy instruments/policies								
Aquaculture with increased immigration	5.8%	20.0%	5.1%	19.1%	5.1%	17.8%	3.2%	13.8%
Aquaculture with increased R&D and education	6.2%	14.1%	6.4%	11.8%	6.1%	12.0%	3.0%	4.7%
Tourism with increased R&D and education	3.6%	3.8%	4.7%	5.4%	3.9%	4.1%	2.9%	4.0%
Minerals with increased R&D and education	4.0%	4.2%	4.5%	5.1%	4.8%	4.9%	2.0%	4.0%
Renewables with increased R&D and education	5.2%	9.7%	4.9%	6.8%	5.1%	8.4%	2.9%	4.3%
Aquaculture and tourism with increased R&D and education	6.9%	14.7%	6.4%	11.1%	5.6%	9.8%	3.0%	4.7%

Source: Menon/Vista Analyse

economy (Meld. St. 12 (2012-2013)). But we have also seen that increasing access to labour, or making labour more productive by prioritising education and R&D, can have a relatively large impact on value creation. It is therefore of interest to look at combinations of stimulating business while prioritising education and R&D or increased immigration.¹⁰

¹⁰ In the combinations with increased education and R&D these prioritisations are distributed evenly in Norway, which means that the effects are smaller

Table 6.9 presents the results of these analyses, and for the sake of comparison the table also includes figures for increased value creation in the individual areas if industry-oriented policy instruments are used.

than they would have been if the prioritisations had been channelled to Northern Norway, as they are in the simulations presented in Tables 6.5-6.7.

Increased prioritisation of aquaculture with increased immigration

A combination of increased prioritisation of aquaculture and increased immigration produces far-reaching and much larger effects than purely prioritising aquaculture. Essentially, these measures operate independently of each other. The sum of the two separate measures of increased immigration and prioritisation of aquaculture is nearly identical to the results of the joint simulation. Increased prioritisation of aquaculture has a small impact on the labour market, as it is not a very labour-intensive industry. Similarly we cannot expect increased immigration to have any impact on value creation in the aquaculture industry since it is exogenous. Increased immigration thus helps equalise the displacement effect that would be produced by prioritising aquaculture in isolation.

Equivalent simulations were not carried out for the other industries, but there is reason to assume that the effects would be similar, i.e. reduction or equalisation of the displacement effects.

Increased prioritisation of aquaculture with increased R&D and education

On the one hand, increased prioritisation of aquaculture combined with broad-based prioritisation of R&D and education will put the aquaculture industry into competition with public services for access to labour, but, on the other hand, increased prioritisation of R&D will help to increase productivity in the aquaculture industry. The latter means that value creation is somewhat larger in the aquaculture industry than in the straightforward aquaculture simulation, while combined prioritisation does not displace other business to the same extent. Increased productivity means that value creation per employee increases, in other words not as many people are needed to carry out the same tasks.

Prioritisation of tourism with increased R&D and education

Increased prioritisation of the tourism industry combined with increased prioritisation of R&D and education helps to increase value creation 3-6% in 2030 and 2060 compared with the reference scenario. Virtually all of this increase is due to the growth generated by increased R&D and education. The additional increase produced by the tourism measures is marginal, as the displacement effects are relatively large. The tourism industry becomes slightly more productive as a result of increased R&D, but because it is not very education intensive, it will not benefit much from education, and because it is labour intensive, the measures will contribute to displacement from other labour-intensive industries.

Increased prioritisation of the mineral industry with increased R&D and education

Increased mineral production and increased prioritisation of R&D and education produce similar results to the combination of aquaculture, R&D and education. The mineral industry benefits slightly from the increased supply of labour with higher education, and the impact of R&D on the industry is reflected to a small extent in the form of an accelerating effect on value creation in the industry.

Increased prioritisation of renewable energy with increased R&D and education

Increased prioritisation of renewable energy production produced substantial displacement effects. If this is combined with increased R&D and education, it seems that prioritisation of renewables is less marked by strong displacement effects. The coordinated use of policy instruments contributes to an increase in value creation in the counties of Northern Norway that exceeds by far the sum of the separate simulations. Increasing access to highly competent labour while making production more efficient reduces the need to attract labour and capital from alternative uses in the economy.

Increased prioritisation of tourism and aquaculture with increased R&D and education

The final combined analysis includes increased prioritisation of aquaculture, tourism, R&D and education.

As with the previous analyses, combining policy instruments will to some extent counteract the displacement effects that the purely sector-specific policy instruments targeted at tourism and aquaculture respectively

produce. The combination of policy instruments gives slightly higher value creation in Nordland than in the other two counties. This is probably due to aquaculture making up a larger proportion of the economy in Nordland than in the other counties and a good part of the increase in tourism activity happening in Nordland as a result of the airport expansions there.

7

Future North

Photo: Sónia Arrepiá Photography, Visitnorway.com, Haukland

And what a country it is. The north country. Where deep-blue mountains, chalk-white beaches and gold-sprinkled cloudberry bogs lie swathed in northern lights and midnight sun. Off the coast the sea boils in a silvery profusion that invites kittiwakes and minke whales to frolic. Fresh spring water finds its way down the mountainsides and out to the sea through green meadows. Sheltered by the mountains, the rich soil gives nourishment to edible plants – side by side with valuable rocks. And the sea. The sea conceals other treasures for ages to come. In its winds, tides and waves. In the seabed itself. And in wide open spaces with room for new thoughts and ideas.

In the beginning the ice created the land. And so the north-facing tapestry of our age extends into the future, just as white and open. Where new weft threads will be woven in. Where patterns in new colour combinations will take shape. Where the future in the north will appear. Woven by the people who call the north country our home – now and in 2050.

Kriss Rokkan Iversen

It is the ambition of Knowledge Gathering – Value Creation in the North to say something about the future possibilities for some important industries in Northern Norway. The overarching problems were as follows:

- What is the potential for future value creation within the marine industries (seafood), tourism, renewable energy, the mineral industry, and other industry and business in Northern Norway? What will this mean for future employment in the industries in question?
- What is needed to realise the potential for value creation? What are the most important challenges and how can they be dealt with? What are the most effective policy instruments for providing a framework for profitable growth?
- What might Northern Norway be like in 2030, looking ahead to 2060?

Predicting what will happen in the future is a difficult, not to say impossible, task, particularly over a long time frame. Therefore, we have not ventured to say what will happen, but rather to show what might happen. The purpose of the future prospects is primarily to provide a basis for what can or should be done in order to realise the potential for business development that exists, but will not necessarily materialise by itself.

As predicting the future is a difficult task, we approached the future using several different methods.

- Simple projection of the individual industries.
All these projections are partial, as they only look at

the development in a single industry and do not take account of possible restrictions on access to labour.

- Projection of different policy instrument use, including packages of policy instruments, with the NOREG economic model.
- Qualitative pictures of the future

As mentioned in the introduction, none of these methods gives the final word on future value creation, but looking at them in connection with each other can provide us with a better, more complete basis for assessing future development.

The sectoral analyses provide pictures of individual industries and simple projections of the possibilities for increased growth by pointing to framework conditions and measures; these projections can be found in Appendix 3. The primary purpose of these projections is to explore the potential for each individual industry. The projections can be tools for the industries themselves. They also have their limitations in that they are partial and do not take the big picture into account.

The economic model does take account of the big picture. The strength of the model is that it makes allowance for some fundamental interrelationships in the economy, such as access to resources and other restrictions. The projections of the sector-specific prioritisations clearly show that one-sided prioritisation of a single industry will be positive for that industry, but at the same time produce major displacement effects for other industries and so have little overall impact on either the regional or national

economy, see Chapter 6. If, however, these prioritisations are combined with policy instruments that either increase access to resources (such as labour immigration) or make the resources more efficient (such as increased education and R&D), there will be synergy effects that benefit many industries.

Just like the economic model, the scenario process also takes an integrated approach, but qualitative rather than quantitative. Nor are the results of a scenario process limited to the qualitative pictures of the future. The actual process, involving many different business players, is in itself an important and hopefully instructive arena. Giving the players who take part a better basis for drawing up strategies and planning for the future is an important object.

The pictures of the future are well suited to discussing the big picture, where the different industries can be seen together, and where it is also possible to appreciate more fundamental changes in the economy and framework conditions than a model can handle. The pictures of the future can also say something about the scope for business development in Northern Norway.

7.1 Significance of uncertain driving forces

In our overall assessment of the future the uncertain driving forces may be the most important outcome of the scenario process, see also Chapter 3. According to the business players who took part in the process, these driving forces are among the most important drivers for future value creation in Northern Norway.

There are fundamental differences between a qualitative scenario process and a quantitative economic model, and in many ways they represent two methodological extremes. In a scenario process there is great freedom to think outside the box, while a model requires given conditions to be taken into account. We nevertheless attempted to use the two methods simultaneously to take an in-depth look at how the uncertain driving forces could impact on the economy of Northern Norway. We therefore supplemented the

qualitative pictures of the future with quantitative model analyses of the uncertain driving forces:

- Will there be willingness to introduce international/supranational *climate policy* regulations or will the current situation, with few binding agreements, persist?
- How extensive will *petroleum activity* in the north be? How big will the finds be and will they generate business on land in Northern Norway?
- How will the attitude to *knowledge and innovation* develop in Northern Norway?

This does not mean that other driving forces may not be at least as important for development, but these were the uncertain driving forces identified in the knowledge-gathering project's scenario process. In principle, the key certain driving forces should already have been taken into account in the reference scenario in the NOREG economic model (see also Appendix 4). These include an ageing population, technological development and growth in demand for experiences.

7.2 What will stricter climate policy mean?

Two of the pictures of the future are based on a much stricter climate policy than is currently the case. The difference between the two pictures of the future is that one is essentially based on regulations and requirements for reduced emissions, while the other is based more on high CO₂ prices. Higher CO₂ prices are the simplest approach when modelling stricter climate policy.

The climate policy simulation in NOREG assumes that the cost of CO₂ will increase to NOK 1,500 per tonne in 2020 and NOK 1,800 per tonne in 2050. This will impact on the world market price for petroleum products, which the simulation assumes will fall by 1.5% per annum, resulting in a 50% reduction by 2050.¹ The cost

¹ In NOREG oil and gas production is exogenous, i.e. defined outside the model. The price drop will cause a sharp reduction in profitability in the industry, which would normally lead to reduced oil and gas production over time, but this was not entered in the model, which probably means that the positive effects have been overestimated slightly.

TABLE 7.1
Effects of climate policy measures on value creation (GRP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Increase in GRP / GDP	3.1%	20.0%	0.5%	3.9%	2.0%	13.3%	0.6%	4.9%
Increase in employment	0.6%	3.1%	-0.1%	-0.7%	0.2%	0.6%	0.0%	0.0%
Increase in proportion with higher education	0.0%	0.2%	0.0%	0.1%	0.0%	0.4%	0.0%	0.0%

Source: Menon/Vista Analyse

of CO₂ will also affect energy prices, as European power production has high CO₂ emissions from coal-fired power plants in particular. It is assumed that the cost of energy will increase by NOK 0.73 (to NOK 1 per kWh) in 2020 and then remain constant until 2050.

The impact of the climate measures on value creation in the region is relatively large, see Table 7.1. The impact is considerable in Nordland in particular, driven by increased production of renewable energy. In the model this is governed by the fact that renewable energy production is particularly high in Nordland in the base year, but the calculations of production potential in Analyse & Strategi et al. (2013) also show the potential to be largest in that county (see also Figure 4.2).

Higher energy prices on foreign markets will boost Norwegian exports of renewable energy, and it is this export effect that boosts value creation in renewable energy in Northern Norway. Domestic demand for energy falls slightly as a result of the higher prices. Enterprises try to wean themselves off power and industries that are power intensive play a less important role in the economy relatively speaking. In 2060, value creation in the renewable energy sector is 137%

higher than in the reference scenario, which has a considerable impact on national GDP (approx. 5%). But it will also cause displacement effects for other industries, just as with one-sided prioritisation of the renewable energy industry.

The results from NOREG tally well with the 'Climate innovation' picture of the future, in which climate policy drives strong innovation in renewable energy, but without much benefit for domestic industry.

7.3 How important will petroleum activity be?

In two of the pictures of the future it is assumed that petroleum activity will increase in the region, without it being specified how this will happen. In order to illustrate what this may mean for value creation in Northern Norway, a simulation was carried out that is consistent with the Norwegian Petroleum Directorate's estimates for future oil and gas production, in which assessments of remaining and undiscovered fields play a key role. Based on this, a projection was made of value creation on the different parts of the continental shelf as described in Table 7.2. Activity in the Norwegian Sea South and Barents Sea in particular is expected to be much higher than in the reference scenario.

TABLE 7.2

Development in value creation from the Norwegian continental shelf in the reference scenario and oil scenario respectively. NOK billions, 2010 prices.

	REFERENCE SCENARIO					OIL SCENARIO			
	2010	2020	2030	2060		2010	2020	2030	2060
Mainland	50	46	38	12	Mainland	50	46	38	19
North Sea South	194	178	147	47	North Sea South	194	178	147	72
North Sea North	194	178	147	47	North Sea North	194	178	147	72
Norwegian Sea South	78	71	59	19	Norwegian Sea South	78	140	130	67
Norwegian Sea North	4	4	3	1	Norwegian Sea North	4	21	21	11
Barents Sea	8	7	6	2	Barents Sea	8	37	122	149
Total	529	486	399	128	Total	529	601	605	390

Source: Norwegian Petroleum Directorate, worked up by Menon/Vista Analyse

Table 7.3 presents the results from the simulation with increased petroleum activity in the Barents Sea.² Such a large increase will draw heavily on resources that are being used elsewhere, i.e. have major displacement effects.

Economic activity in Finnmark increases strongly by all of 54% compared with the reference scenario. The growth is driven by a sharp increase in production in other industry and private services supplying the oil and gas sector. Other industry goes from a 3% to a 12% share of value creation in the county in 2050.

Nationally, increased oil and gas activity will have a more moderate impact on value creation. Even a level of oil production that is three times higher than in the

² In the case of this simulation the figures are for 2050 rather than 2060, as NOREG has problems resolving the years after 2050 with such a radical change in the structure of the economy. It also means that the results from this simulation are uncertain.

reference scenario in 2050 only has moderate effects nationally in the long term.

In both pictures of the future with high activity in the petroleum industry there is a great need for labour. This is especially noticeable in 'Gas rules', where it is Chinese construction workers who fulfil the increased demand. It is assumed that there will be not inconsiderable labour immigration in 'Class society in the north' too.

In both pictures of the future with high petroleum activity it is probable that the public sector and service industries will initially be towed along in the slipstream of this growth. Other business, on the other hand, could soon play a subordinate role. High pay in the petroleum industry will force up costs in other sectors. The more important petroleum activity becomes for the region overall, the harder it will be for other industries to obtain qualified labour.

TABLE 7.3
Effects of increased petroleum activity in the Barents Sea on value creation (GRP) and employment in the counties of Northern Norway and Norway as a whole. Percentage change in relation to the reference scenario

	NORDLAND		TROMS		FINNMARK		NORWAY	
	2030	2060	2030	2060	2030	2060	2030	2060
Increase in GRP / GDP	0.6%	2.9%	1.6%	15.4%	13.4%	54.4%	4.2%	3.2%
Increase in employment	3.1%	4.5%	7.6%	25.8%	12.7%	38.3%	5.9%	25.6% ¹
Increase in proportion with higher education	0.0%	-0.3%	-0.3%	-0.5%	-1.3%	-1.2%	0.0%	-0.1%

¹ Result of increased immigration nationally

Source: Menon/Vista Analyse

7.4 How important will competence be?

Three of the pictures of the future are based on an assumption of high competence and innovative business. In 'Climate innovation' and 'Taking matters into our own hands' this is driven by strong public prioritisation of industry-oriented R&D, for example, while in 'Class society in the north' it is driven by business development itself. As shown in Chapter 6, the projections of prioritisations of both education and R&D in NOREG show what is in part a strong increase in value creation in the three counties. This demonstrates the importance of competent labour and innovative enterprises. Particularly in a situation where labour is a limited resource, and will probably become even more limited over time (see the discussion in Angell et al. (2013)), it is vital to increase competence and research efforts in order to raise productivity.

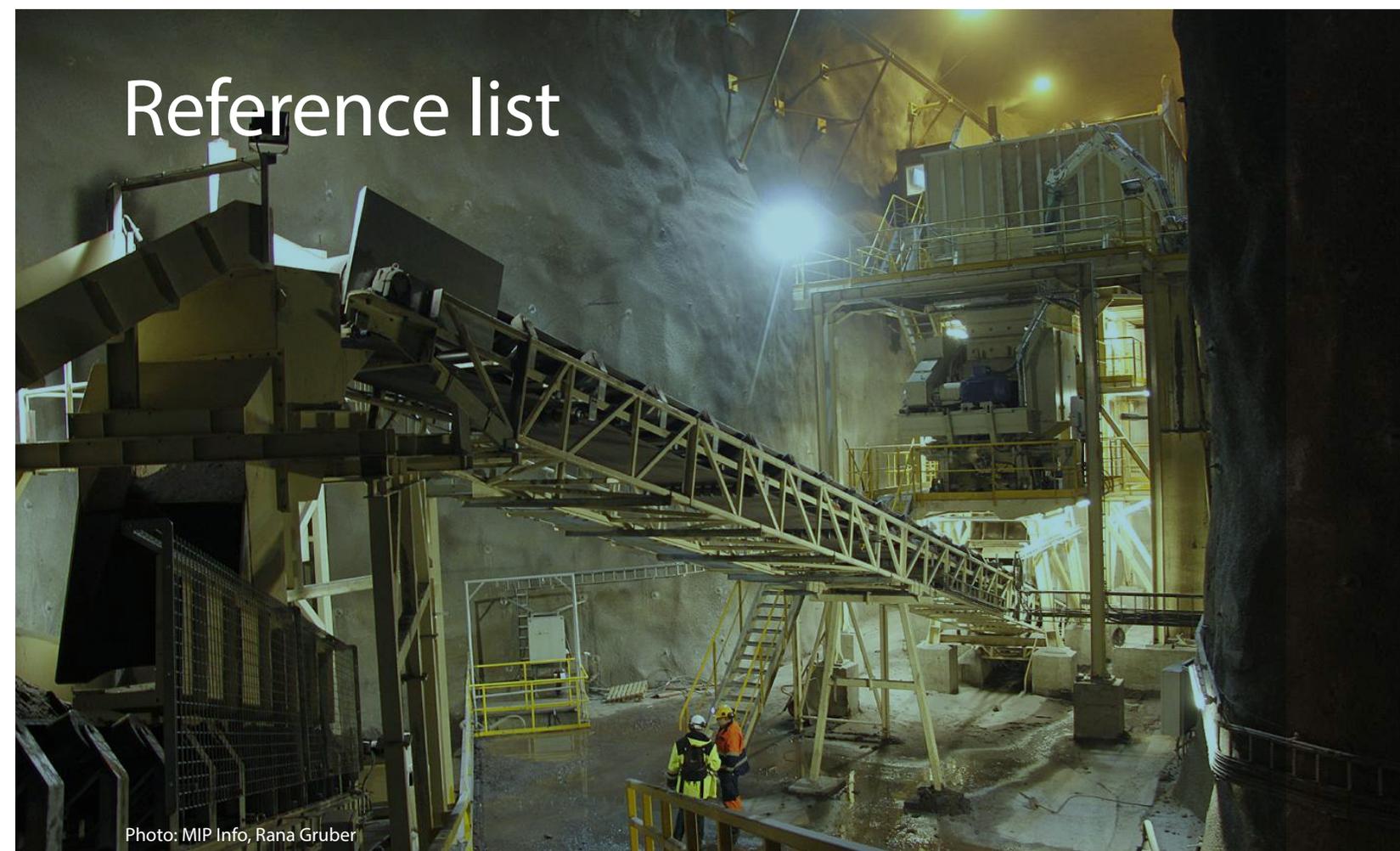
7.5 Conclusion

Knowledge Gathering – Value Creation in the North was given the mandate of investigating and visualising the possibilities for increased future value creation in key industries in Northern Norway. We took a detailed look at important input factors, current activity, the most

important challenges, and the policy instruments and prioritisations that might be used to deal with the challenges and facilitate growth. All the methods used to look into the future show that there is considerable potential for increased value creation in Northern Norway, but also that such growth will not happen by itself. In order to boost value creation and make it more attractive to live and do business in Northern Norway, efforts will be required from national, regional and local players, the public sector and, not least, the business players themselves. The knowledge-gathering project tries to say something about what the scope is and what effects different prioritisations may lead to, not what the actual road ahead is. We nevertheless hope that the knowledge-gathering project will help to improve the decision-making basis for the choices that have to be made, and that active use will be made of the projects overall result in the ongoing work to generate increased value creation and good communities in Northern Norway.

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Photo: MIP Info, Rana Gruber



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Appendices



Photo: CH/Innovation Norway, Lofoten

Appendix 1: Definitions

Value creation In the knowledge-gathering project value creation is measured as enterprises' turnover less goods and services purchased, i.e. the sum of payroll costs and operating profit before depreciation and write-downs (otherwise known as EBITDA, earnings before interest, taxes, depreciation and amortisation). Using this measure of value creation instead of turnover avoids counting goods and services twice. It also provides an estimate of social return in that it shows payments to the main stakeholders: wages and salaries paid to employees, tax paid to local and central government, interest paid to creditors and return paid to owners.

At national level value creation is measured in terms of gross domestic product (GDP). GDP divided between the counties is sometimes referred to as gross regional product (GRP).

Gross product Value creation and earned gross income from domestic production activity in an industry or sector (or in total for all industries/sectors), derived and defined as production less product inputs. Gross product is published as basic value, i.e. product subsidies are included, but not value-added tax or other product taxes.

In public administration and other non-market-oriented activity gross product is determined as payroll costs, net production taxes and capital depreciation.

Return on investment Return on investment is expressed as a percentage and calculated as operating profit plus financial income divided by total capital. Return on investment says how much the capital invested in an enterprise yields in a year. A high return on investment generally means that further growth is possible, making it of interest to invest in the industry, while the opposite is true in the case of a low return on investment. If return on investment is lower than the interest rate in the country, the enterprise/industry is in a vulnerable position, as the owners would earn more by placing the capital in risk-free bank investments than by investing in the industry. This also means that all debt-financed capital invested in the industry will go into the red and interest costs will eat into equity.

Appendix 2: Policy instruments

SECTORAL ANALYSIS FOR THE MARINE INDUSTRIES IN NORTHERN NORWAY (Winther et al., 2013)	
Industry	Policy instrument/policy recommendation/measure
Fisheries	Integrated ecosystem-based management
	Development of live catching and intermediate storage of commercially important species
	Focus more on the market, with higher quality, new products and logistics
	Strengthen enterprises' cooperation on innovation
Aquaculture	Identify the best areas for farming salmon and other species, establish a structure that ensures optimum conditions for business and take the necessary account of environmental sustainability
	Introduction of a new area system in a way that looks after the legitimacy of the aquaculture industry locally, regionally and nationally
	Development of vaccines and prioritisation of sterile fish
	Development of technological and other solutions that ensure environmental sustainability
Biomarine industries and new industries	Provide a framework for increased smolt production in Northern Norway and grant more fish farming licences
	Further develop strong expert environments
	Different and, in part, new policy instruments for new industries rather than those for the existing industries
	Measures to enhance access to 'special' risk-taking capital
	Stronger/stricter filtering and selection of possible potential commercial ideas within the biomarine industries
	Funding for testing different farmed species and development of concepts linked to them
	Pilot projects aimed at exploiting feed waste and nutritive salts from aquaculture for the cultivation of macroalgae (kelp) and conducting Integrated Multi-Trophic Aquaculture (IMTA)
	Increase the knowledge base with a view to providing a framework for stimulating natural production and biological turnover in fjords and other waters
	Market funding to develop markets for new farmed species
	A boost for Northern Norway and business there through a public, industry-relevant research effort and provision of a framework for research in business
General policy instruments and measures, and measures targeted at several industries	Maintain a good education structure and high course quality
	Closer cooperation between educational institutions at all levels and the industry
	Provide a framework for solutions that offer incentives for players at all levels to prepare the way for growth in marine industries, including at municipal level
	Develop the knowledge base with regard to opportunities and challenges presented by co-existence between the various marine industries, and between the marine industries and other industries that use the marine environment
	The creation and development of clusters and cooperation should be stimulated both within existing industries and for the development of new industries
	Enterprises in the marine sector must invest heavily in R&D themselves and become a demanding research client for national and international research environments
	Develop schemes that are specially tailored to the supplier sector to provide risk relief for the development of new technology and new products.
	Provide stimulation for starting up supplier development programmes on the oil industry model
	Further development of administrative competence
	The marine industries must have roughly the same competitive conditions in the form of framework conditions as other industries
SECTORAL ANALYSIS FOR RENEWABLE ENERGY (HYDROPOWER, WIND POWER (LAND-BASED AND OFFSHORE), TIDAL AND WAVE POWER, SOLAR POWER AND THERMAL ENERGY) (Analyse & Strategi et al, 2013)	
Industry	Policy instrument/policy recommendation/measure
General policy instruments and measures	Organising the grid and expanding it to meet power producers' needs. Increased power production could generate increased value creation in the region as a whole if industries that base their value creation on local renewable energy are developed at the same time. Alternatively, value creation can be increased by exporting more power. In this case export capacity out of NO ₄ will have to be boosted.

Increased focus on the exploitation of renewable energy to establish new energy-intensive industry, and to strengthen and develop existing industry.

Implementing measures to attract labour to the region and reduce the number of people moving away. By, for example, the Norwegian State Educational Loan Fund increasing student loan rebates from the current level of 10% for borrowers who settle in Finnmark or Nord-Troms. The industry can request the State Educational Loan Fund and national authorities to enlarge or enhance the scheme. Other measures include more favourable home ownership schemes.

Developing a closer and stronger subcontractor industry by creating business clusters and incubators. The subcontractor industries should also be included in the start-up phase and analysis of what competence is in short supply, and what competence development in particular should be stimulated in the education system.

Increased focus and allocation of funds for prioritisation of R&D, innovation and entrepreneurship in the renewables sector in Northern Norway.

Integrated plan and framework (a kind of national energy plan along the lines of the National Transport Plan).

Electrification of the Norwegian continental shelf

Reduced processing times on the part of the authorities. Capacity must be increased at every stage of licence processing (Norwegian Water Resources and Energy Directorate and Ministry of Petroleum and Energy).

THE MINERAL INDUSTRY (ORES AND INDUSTRIAL MINERALS) (Vista Analyse and Sweco, 2013)

Industry	Policy instrument/policy recommendation/measure
General policy instruments and measures	A complete change in current licensing policy, with central government taking over responsibility for licence processing (environment/area regulation). Faster and more streamlined processing. Acceptance of some negative consequences that can be compensated for financially to a certain extent.
	Tax relief (for a limited period) to bring foreign players into the mineral industry in the north. Tax measures should be general and cover all industries in Northern Norway, however. Any need for selective measures for individual enterprises or industries should be covered by government loans and grants, for example.
	Boosting major research projects, e.g. to find new and more efficient ways of treating and exploiting mine waste sustainably, and general environmental considerations
	Increased prioritisation of surveying on the part of central government. This should be linked to marketing the region as an attractive investment region and possible financial incentives.

TOURISM INDUSTRY (ACCOMMODATION, TRANSPORT, CATERING, EXPERIENCES AND AGENCY SERVICES) (Enger et al., 2013a)

Industry	Policy instrument/policy recommendation/measure
General policy instruments and measures	Better accessibility – e.g. by switching from a large number of local to fewer regional airports (especially in Nordland with a large airport at Gimsøy, Municipality of Vågan, and at Mo i Rana).
	Creation of a charter fund for Northern Norway to increase charter tourism to the region.
	More efficient and better coordinated marketing through restructuring, and stronger product-market links. Tripling marketing spend over and above general growth.
	Restructuring the destination companies, and doubling the spend on destination development up to 2015. Followed by an annual increase of 4%.
	Increase the number of professional players by stimulating start-ups by marketing the opportunities for start-ups in Northern Norway to Norwegian and foreign enterprises, reducing start-up costs through competence raising, contact with clusters, information on support schemes, etc., and good education provision.

OTHER INDUSTRY AND BUSINESS (Espelien et al., 2013)

Industry	Policy instrument/policy recommendation/measure
General policy instruments and measures	Develop knowledge-based business, in order to keep highly educated young people in the region, in industries with competitive advantages (proximity to natural resources) in Northern Norway.
	Further develop strong growth areas with ripple effects to smaller areas
	Specialised business development in some areas to achieve critical mass and cluster effects
	Development of industries with national and/or international customers
	Liberalisation of labour immigration from countries outside the EEA (e.g. Russia)
	Increased oil and gas production in the north can generate growth in other business
	Regional prioritisation of higher education to increase competence in the future labour force
Tax incentives for increased R&D through higher tax deductions in the SkatteFUNN scheme	

COMPETENCE, RESEARCH AND INNOVATION IN NORTHERN NORWAY (Damvad et.al., 2013)	
	Policy instrument/policy recommendation/measure
General policy instruments and measures	General prioritisation of education at all levels
	Enhance continuing education provision at colleges and universities to improve qualifications of existing labour force: there is a need to raise the educational level in all industries in order to boost formal competence levels and potentially contribute to more networks through managers and employees meeting and studying together.
	Work systematically at all administrative levels to increase the number of apprenticeships in view of the fact that there is a shortage of skilled workers and too few are being trained
	Increase the number of graduates and tailor courses to enterprises' needs. Increase prioritisation of career days and forums where R&D players and business can meet
	Ensure informal forums for enterprises and universities, e.g. career days, to further develop cooperation between universities and business
	Draw up industry-based strategies for research and innovation for the various industries with the county councils as coordinator.
	Give universities and colleges a more central role in clusters and networks
	Draw up new initiatives for increasing research and innovation. These new initiatives can be based on experiences from abroad, e.g. the 'knowledge pilot scheme' or innovation networks from Denmark
	Make the private sector more attractive to work in than the public sector
New marine industries and aquaculture	Increase private research efforts
	Research cooperation between companies and universities
Tourism and fisheries	Familiarise enterprises with the innovation system (participation in knowledge networks)
Fisheries	Raise the educational level of the existing workforce in the form of continuing education and training. And increase the general educational level through access to qualified labour
	Access to risk-taking capital. The many small players in the fishing industry rely on investors or a policy instrument apparatus willing to take the risk of working on R&D and innovation.
	Cooperation. Development of forums for cooperation between the players in the industry, and with R&D and knowledge institutions.
Aquaculture	Competence building. Strengthen development programmes for the fishing industry, ARENA programmes and FRAM programmes
	Improvement of infrastructure. Making it less challenging to transport products on Norwegian roads.
	Change in application processes. Application processes in the policy instrument apparatus are too time-consuming and inhibit innovation.
	Focus on reputation building for the industry, and make it attractive for young people to look for work in the aquaculture industry.
Tourism	Development of attractive local communities. If enterprises are to retain competent labour, they are dependent on stable local communities with good public provision
	Cooperation/networks/clusters Strengthening of cooperation/networks/clusters between tourism players, R&D environments and knowledge institutions
	Competence raising. Strengthen competence in the industry. The focus should be on enhanced competence in experience production, for example
	Application processes. The policy instrument apparatus must develop in line with the industry, and simplify application processes
New marine industries	Research. The research produced must be relevant and comprehensible to the industry.
	Support schemes and funding grants. Schemes such as SkatteFUNN, Research Council of Norway, MABIT and Innovation Norway programmes must be strengthened, made accessible and not have overly difficult application processes.
	Policy instrument apparatus. A framework should be provided for innovation by having freely available funds that can be invested in spectacular ideas rather than just working on the basis of five-year plans
	Continuing education and training Crucial for competence raising in the industry.
	Cooperation. Strengthen cooperation between players in the industry, R&D environments and knowledge institutions.
	Focus on disseminating research. A lot of research is carried out, but not presented or implemented in enterprises. New methods must be developed for disseminating research so that it is comprehensible and can be implemented in enterprises.

TRANSPORT INFRASTRUCTURE IN NORTHERN NORWAY (Hansen et.al., 2013)

	Policy instrument/policy recommendation/measure
E6 + county and national roads	Improvement of the road network – maintenance measures to catch up on backlog
	Improvement of the road network – investments that increase predictability for transport
	Increased frequency for key ferry links
Port structure	Strengthen the node function of trunk network ports with rail links in order to establish more sustainable trunk network ports
	Invest in associated logistics solutions and efficient terminal functions for key ports
Railways	Increase the capacity of the Ofoten Line (double track) and improve the quality of the Nordland Line (remote traffic management and track upgrades)
Airports	Creation of larger airports in Helgeland, Lofoton and Hammerfest

ATTRACTIVE LOCAL COMMUNITIES AND LABOUR MARKET REGIONS (Angell et.al., 2013)

	Policy instrument/policy recommendation/measure
Amenities and attractiveness	Work systematically on amenities and challenges. The identity of a place can be changed.
	Support 'enthusiasts' and 'social entrepreneurs' in local communities.
Link between business and local communities	Requirements in the form of concessions, licences and quotas can be imposed on activities where decisions are taken a long way from their location (external owners)
	Create good links between business and local communities, e.g. through institutional steps to strengthen the social contract
Infrastructure and communication	Prioritisation of infrastructure and communication to ensure that the present labour market regions work as well as possible, and with a view to enlarging the labour market regions.
	Use road expansion and boat services for regional enlargement and start where there is most potential. Build infrastructure to make the distance to local centres in their capacity as service centres easier, making service functions and services more readily accessible for people living in the surrounding areas.
	Importance must be attached to the transport needs of business
	Flights (and prices) are important for getting in and out of local areas quickly. Most flights are designed for getting to/from Oslo efficiently. Internal communication in Northern Norway is time-consuming and expensive
Policy instruments for attracting people	Use people-oriented policy instruments. Student loan rebates and tax relief are examples of people-oriented measures that are already in use in Finnmark.
	Changes in the rules for labour immigration from countries outside the EEA
	Work systematically to activate people who are outside the labour market
Policy instruments for better integration	Differentiated housing market This must also include rented housing, with different standards.
	Good integration of new inhabitants. This work must be done at all levels, from central government to local communities and individuals.
	Norwegian language instruction for immigrant workers from abroad.
Policy instruments for increased competence and innovation	Targeted work on competence and innovation in both the private and public sector. It is important in this context to ensure that education at both upper secondary and tertiary level takes place in cooperation between business, public institutions and the education sector.
	(Further) develop models for cooperation between business/labour market in the region and educational institutions.
	Provision of more educational pathways in the region, especially in technological programmes.
	Strengthen the role of upper secondary education as a stable competence environment in local areas that offers the vocational education that is in demand in the region.
	Measures to increase the low proportion of research in business in Northern Norway.
	Stimulate increased innovation in business and the public sector.

Appendix 3: Projections in the sectoral analyses

In accordance with the project mandate, the sectoral analyses included a quantified assessment of the sectors in Northern Norway in 2030, 2050 and 2100 for two different scenarios:

- 1) Possible development if today's framework conditions continue (also called the reference scenario)
- 2) Possible development given an optimum framework, with full implementation of policy instru-

ments/measures (also called the high growth or potential scenario)

It is important to be aware that the figures for value creation and employment for 2030 and 2050 in the "Full implementation" scenario cannot be totted up to obtain total value creation and employment. There will be limitations linked to available labour, for example, that mean that not all industries can exploit their full potential at the same time.

TABLE A3.1
Projected value creation in the sectoral analyses (contribution to GDP, NOK millions)

	STATUS QUO	CURRENT POLICY		FULL IMPLEMENTATION	
	2011	2030	2050	2030	2050
Fisheries, aquaculture and new marine	10,258	21,000	39,000	45,000	170,000
Tourism industry	6,188	8,500	11,200	10,700	13,400
Renewable energy	6,000	10,000	16,200	10,600	19,700
Mineral industry	954	1,900	1,900	4,200	6,000
Other industry and business	62,621	92,800	125,000	143,200 ¹	175,000 ²

¹ The strong growth in other industry and business up to 2030 assumes liberalised immigration, especially in the form of labour immigration from Russia and Ukraine.

² The sectoral analysis for other industry and business does not quantify value creation and employment in the "Full implementation" alternative in 2050. In the table these figures have been projected using the same absolute growth in the period 2030-2050 as for "Current policy".

TABLE A3.2
Projected employment in the sectoral analyses

	STATUS QUO	CURRENT POLICY		FULL IMPLEMENTATION	
	2011	2030	2050	2030	2050
Fisheries, aquaculture and new marine	11,269	14,600	17,100	23,900	57,700
Tourism industry	11,901	12,400	10,160	14,000	11,800
Renewable energy	2,724	- ³	-	-	-
Mineral industry	1,205	1,500	1,000	3,400	3,000
Other industry and business	98,093	106,900	96,800	161,100	145,900

¹ The sectoral analysis for renewable energy does not have projected employment figures, as most forms of renewable energy do not require much labour input relative to the total labour requirement in the economy once the facilities have been commissioned. (...)

Appendix 4: NOREG

A socioeconomic model is required in order to carry out consistent calculations for future value creation and regional employment. There are a number of economic models that can be used for this purpose¹, but as far as is known there is no model that at the same time takes account of the geographical dimension in the ripple effect models (e.g. effects at county or municipality level) and the equilibrium effects in the national macromodels, i.e. it is not possible to use more resources than are available. Work was therefore started on the development of such a model that would allow for real restrictions in the economy (such as access to labour) and the geographical dimension. The model, christened NOREG, is documented in Bruvoll et al. (2014).

The NOREG model is a regional model for Norway with a national macroeconomic superstructure. The national module takes account of the general equilibrium mechanisms between industries and over time, while the regional module describes how production of goods and services is spread across the country over time. The macromodule is a standard applied general equilibrium growth model in which the underlying growth factors are access to labour, access to capital and technological change. Based on estimates for these factors, the economy grows by the production industries obtaining increased access to the primary input factors.

In the regional module, effects on the national economy are spread across all the counties in the country, depending on where in the country the economic change (or policy measure) occurs, and taking account of distances between counties and cumulative effects in the spread of such impacts. In this way the model allows for both the country's geography (distances) and the regions' degree of centralisation (accumulation of economic activity).

¹ Examples of existing models include regional ripple effect models, such as Panda, Menon's GAC model and Pöyry's ripple effect model, and national equilibrium models, such as SNF's total model for the Norwegian economy, Menon's total effect model, the Norwegian Aggregate Model (NAM) and Statistics Norway's models (e.g. MSG).

The simulations using the model are carried out by calculating the macroeconomic effects of various policies (policy instrument use) or other events up to 2060. Then the regional effects are calculated based on the changes nationally. The link between the macromodule and the regional module in the base year and reference scenario is made by distributing national activity at industry level between the counties based on their share of value creation in the industry each year.²

Reference scenario: what happens without changed framework conditions

Norway is a small open economy in which around half of gross domestic product (GDP) is exported and around half of domestic consumption is imported. Norway currently has a substantial positive balance of trade, resulting in a rapidly growing pension fund abroad, but in the longer term imports must equal exports, i.e. the balance of trade must come out even. The model therefore places restrictions on the balance of trade with abroad, i.e. imports cannot be higher than exports. Given the access to primary input factors and balance-of-trade restriction, private consumption is adjusted so that all resources in the economy are used up.

NOREG simulates development in the economy up to 2060, so a number of projections for factors outside the model are required. These factors form the basis for what is called the reference scenario. This is a scenario that functions as a starting point or reference for simulations of changes in policy and economic factors (economic shocks). Importance is attached to the NOREG reference scenario being as close as possible to expected development of the Norwegian economy as set out in the Ministry of Finance's most recent 'Long-term Perspectives on the Norwegian Economy' (Meld. St. nr 12, 2012-2013).

² This means that the model assumes that all the counties operate with the same productivity in the industries. Production, employment, capital use and input use follow the same fractions as value creation.

The key assumptions in the reference scenario include the following:

- Total public consumption is expected to show mean annual growth of 1.7% up to 2060.
- The oil and gas industry will experience a strong decline in activity up to 2060, with an annual fall of 0.7% up to 2020, increasing to -4.2% per annum in the period 2050-2060.
- Labour will grow in accordance with the assumptions in 'Long-term Perspectives on the Norwegian Economy', with annual growth of 0.6% up to 2020, then a gradual reduction to annual growth of 0.2% in the period 2050-2060.
- Capital will see annual growth of 1.0% in total access to capital.
- The balance of trade is adjusted by an annual reduction of 10%. This has a strong braking effect on growth in the pension fund, but also means that we do not eat into the pension fund in the period up to 2060.
- Technological progress is expected to be 1.3%, i.e. slightly lower than the 1.6% in 'Long-term Perspectives on the Norwegian Economy'.³
- The labour force grows in line with the population growth predicted in Statistics Norway's middle alternative <http://ssb.no/befolkning/statistikker/folkfram>.
- The proportion of people with higher education in the labour force grows from 36% in 2012 to 45% in 2030 and 48% from 2042 onwards, see SSB (2013)⁴

GDP grows steadily throughout the period by approximately 2% per annum. Investment growth is also just under 2% per annum, while growth in capital increases marginally over the period. The number of

employees with higher education is defined exogenously and grows relatively quickly to begin with, but growth declines towards 2060. Growth in the number of employees with a low educational level is negative up to around 2040. Owing to population growth, we see a slight increase after that.

Private consumption sees high growth up to 2025, but then growth gradually settles down. Private consumption is determined residually once public consumption, investments, balance of trade and change in stocks have been taken care of. The trade surplus and reduction in stocks lead to high growth in consumption in the first few years, and correspondingly lower growth by degrees thereafter in the reference scenario. Production and value creation are determined by who controls the model in the following industries in the reference scenario: fisheries, aquaculture, oil and gas, and renewable energy. This is because these are typically industries based on natural resources, where production is largely controlled by natural factors or political regulation of use. Production and value creation in the other industries are determined by the model. The industries' share of total value creation is shown in Table A4.1.

The national reference scenario is distributed between the country's counties, and the counties with high production in the industries that grow a lot relatively speaking in the period up to 2060 will have their share of national value creation increased, and vice versa. Figure A4.1 shows how the regional value creation landscape changes over time in the reference scenario when oil and gas production is excluded.

Rogaland, Møre og Romsdal and Vestfold's share of national value creation will be reduced, mainly as a result of the downscaling of the oil and gas industry. At the other end of the scale we find Oslo, Akershus, Sogn and Fjordane, and to some extent Nordland. This is due to the combined predominance of private services and renewable energy in these counties – both industries that will grow a lot in the reference scenario.

³ Technological growth controls much of the growth in the economy, and to ensure that NOREG does not generate much higher growth than the reference scenario in 'Long-term Perspectives on the Norwegian Economy', slightly lower technological progress is used for technical reasons

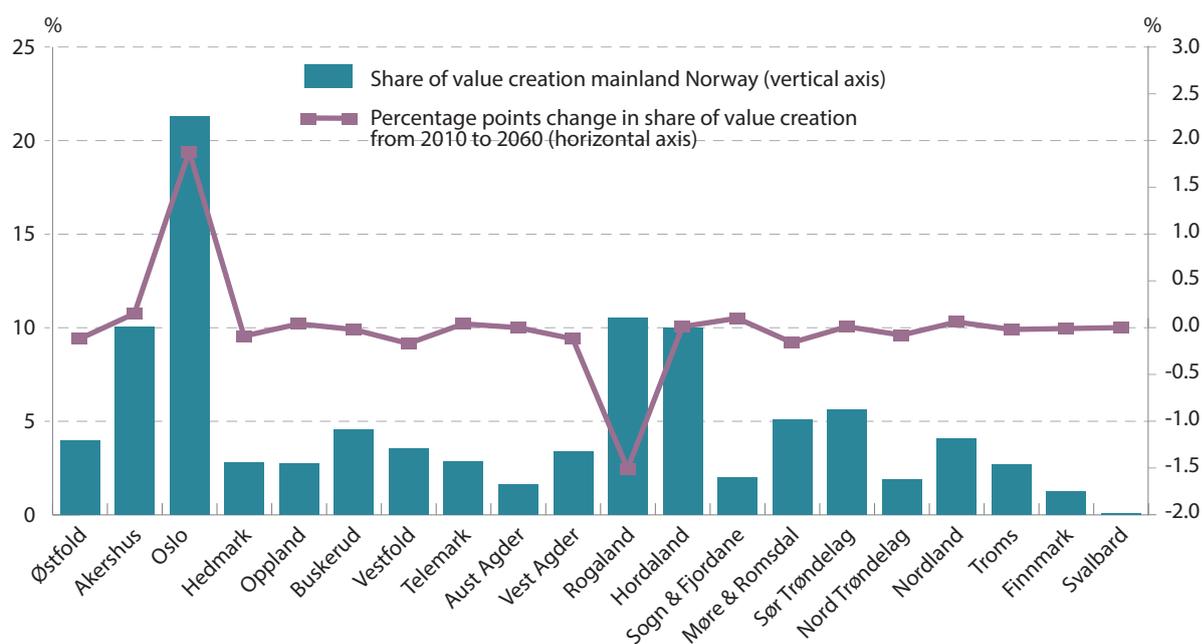
⁴ 15/2013 'Educational behavior in the dynamic micro-simulation model MOSART'

TABLE A4.1
The industries' share of total value creation from 2010 to 2060 in the NOREG reference scenario

	FISHERIES	AQUACUL- TURE	TOURISM	RENEWABLE ENERGY	MINERAL INDUSTRY	OIL & GAS	OTHER INDUSTRY	BUILDING & CONSTRUC- TION	INFRA- STRUCTURE	PRIVATE SERVICES	PUBLIC SER- VICES
The industry's share of total value creation											
2010	0.4%	0.6%	1.5%	2.5%	0.2%	22.8%	8.4%	5.5%	3.4%	33.7%	21.0%
2020	0.5%	0.6%	2.1%	3.2%	0.2%	17.2%	9.1%	4.6%	3.9%	37.0%	21.7%
2030	0.6%	0.5%	2.8%	3.7%	0.2%	11.7%	9.9%	4.3%	4.2%	40.1%	22.0%
2060	0.6%	0.4%	6.7%	5.3%	0.1%	2.1%	6.8%	4.5%	4.4%	47.5%	21.5%
The industries' share of total value creation without oil and gas											
2010	0.5%	0.7%	1.9%	3.3%	0.3%		10.9%	7.2%	4.4%	43.6%	27.1%
2020	0.6%	0.7%	2.5%	3.9%	0.2%		11.0%	5.5%	4.7%	44.7%	26.2%
2030	0.7%	0.6%	3.2%	4.2%	0.2%		11.2%	4.9%	4.8%	45.4%	24.9%
2060	0.6%	0.5%	6.8%	5.4%	0.1%		6.9%	4.6%	4.5%	48.6%	22.0%
Annual growth in the industries											
2010-2020	4.3%	1.9%	5.5%	4.3%	1.1%	-0.8%	2.7%	0.1%	3.3%	3.0%	2.3%
2020-2030	3.5%	1.6%	4.9%	3.3%	2.2%	-1.9%	2.7%	1.2%	2.7%	2.7%	2.0%
2030-2060	1.6%	1.2%	4.9%	3.2%	-0.7%	-3.7%	0.6%	2.1%	2.0%	2.5%	1.8%
2010-2060	2.5%	1.4%	5.0%	3.4%	0.2%	-2.8%	1.5%	1.5%	2.4%	2.6%	2.0%

Source: Menon/Vista Analyse

FIGURE A4.1
The counties' share of national value creation (GDP) in 2010 and change up to 2060



Source: Menon/Vista Analyse

Overall, Northern Norway's share of national value creation will increase from 6.4% in 2010 to 7.9% in 2060, but if oil and gas production is excluded, the share remains unchanged over time at around 8.2%. This is the result of different industries growing at different speeds in the reference scenario and these industries being of varying importance for the economy in Northern Norway.

For a more detailed description of the reference scenario, see Bruvoll et al. (2014).

Appendix 5: Industrial classification

Marine industries

Code	Title
03.111	Ocean and coastal water fishing
03.120	Freshwater fishing
03.211	Production of edible fish, molluscs, crustaceans and echinoderms in ocean- and coast-based aquaculture
03.212	Production of fry and young fish in ocean- and coast-based aquaculture
03.213	Services incidental to ocean- and coast-based aquaculture
03.221	Production of edible fish, molluscs and crustaceans in freshwater-based aquaculture
03.222	Production of fry and young fish in freshwater-based aquaculture
10.201	Production of salted fish, dried fish and clipfish
10.202	Freezing of fish, fish fillets, shellfish and molluscs
10.203	Production of tinned fish
10.209	Slaughtering, processing and preserving of fish and other fish products
10.411	Production of raw fish oils and fats
46.381	Wholesale of fish, shellfish and molluscs

Tourism

Code	Title
49.392	Coach transport
49.393	Transport by cable car, funicular and ski lift
50.102	Internal coastal water transport for passengers
50.109	Other coastal water transport for passengers
50.300	Passenger transport on rivers and lakes
51.100	Passenger air transport
55.101	Operation of hotels, boarding houses and motels with restaurant
55.102	Operation of hotels, boarding houses and motels without restaurant
55.201	Operation of youth hostels
55.202	Operation of holiday apartments
55.300	Operation of campsites
56.101	Operation of restaurants and cafés
56.301	Operation of pubs
56.309	Operation of other bars
79.110	Travel agency activities
79.120	Tour operator activities
79.901	Tourist office activities and excursion companies
79.902	Guides and couriers
79.903	Experience, event and activity organiser activities
79.909	Tourist-related services not elsewhere classified
93.210	Operation of amusement and theme parks
93.291	Experience activities
93.292	Recreation centres
93.299	Other recreation activities

Renewable energy

Code	Title
35.111	Electricity production from hydropower
35.112	Electricity production from wind power
35.113	Electricity production from biofuel
35.114	Electricity production from natural gas
35.114	Other electricity production
35.120	Electricity transmission
35.130	Electricity distribution
35.140	Trade of electricity
35.300	Steam and hot water supply

Mineral industry

Code	Title
07.100	Mining of iron ores
07.210	Mining of uranium and thorium ores

07.290	Mining of other non-ferrous metal ores
08.111	Quarrying of stone for building and construction activities
08.112	Quarrying of limestone, gypsum and chalk
08.113	Quarrying of slate
08.120	Extraction from gravel and sand pits, and extraction of clays and kaolin
08.910	Mining and extraction of chemical and fertiliser minerals
08.990	Other mining, quarrying and extraction not elsewhere classified
09.900	Services incidental to other mining and quarrying

Oil & maritime

Code	Title
46.692	Wholesale of ship's equipment and fishing gear
06.100	Extraction of crude petroleum
06.200	Extraction of natural gas
09.101	Drilling services incidental to extraction of crude petroleum and natural gas
09.109	Other services incidental to extraction of crude petroleum and natural gas
28.110	Manufacture of engines and turbines, except aircraft and vehicle engines
28.221	Manufacture of lifting and handling equipment for ships and boats
30.111	Building of ships and hulls over 100 GRT
30.112	Building of ships under 100 GRT
30.113	Building of oil platforms and modules
30.114	Manufacture of other floating structures
30.115	Fitting-out and installation work carried out on ships over 100 GRT
30.116	Fitting-out and installation work carried out on oil platforms and modules
30.120	Building of pleasure boats
33.150	Repair and maintenance of ships and boats
46.692	Wholesale of pleasure boats and equipment
47.642	Retail sale of pleasure boats and equipment
50.201	Foreign freight shipping
50.202	Internal freight shipping
50.203	Tugboats
50.204	Supply and other sea transport services for offshore
52.221	Operation of port and quay facilities
52.223	Supply bases
52.229	Other services incidental to sea transport
52.292	Shipbroking
71.122	Geological surveys
77.340	Renting and leasing of sea transport equipment

Industry

Code	Title
10.110	Processing and preserving of meat
10.130	Manufacture of meat and poultry products
10.310	Processing and preserving of potatoes
10.413	Manufacture of refined oils and fats
10.420	Manufacturer of margarine and similar edible fats
10.510	Manufacturer of dairy products
10.520	Ice cream production
10.710	Manufacture of bread and fresh bakery products
10.810	Manufacture of sugar
10.860	Manufacture of homogenised food preparations and dietetic food
10.890	Manufacture of food products not elsewhere classified
10.910	Manufacture of prepared feeds for farm animals
11.020	Manufacture of wine
11.050	Manufacture of beer
11.070	Manufacture of mineral waters, soft drinks and other bottled waters
13.300	Finishing of textiles
13.921	Manufacture of soft furnishings

13.929	Manufacture of other articles made from textiles, except apparel
13.940	Manufacture of cordage, rope, twine and netting
13.950	Manufacture of non-wovens and articles made from non-wovens, except apparel
13.960	Manufacture of other technical and industrial textiles
13.990	Manufacture of other textiles not elsewhere classified
14.130	Manufacture of other outerwear
14.190	Manufacture of other wearing apparel and accessories
16.240	Manufacture of wooden packing goods
17.230	Manufacture of paper stationery
19.200	Manufacture of refined petroleum products
20.110	Manufacture of industrial gases
20.120	Manufacture of dyes and pigments
20.130	Manufacture of other inorganic chemicals
20.140	Manufacture of other organic basic chemicals
20.150	Manufacture of fertilisers, nitrogen compounds and potting soil
20.160	Manufacture of plastics in primary forms
20.420	Manufacture of perfumes and toilet preparations
20.590	Manufacture of other chemical products not elsewhere classified
22.210	Manufacture of plastic semi-manufactures
22.220	Manufacture of plastic packing goods
22.290	Manufacture of other plastic products
23.130	Manufacture of glass and crystal packing goods and household articles
23.200	Manufacture of refractory products
23.520	Manufacture of lime and plaster
23.990	Manufacture of other non-metallic mineral products not elsewhere classified
24.200	Manufacture of other pipes and pipe fittings of steel
24.421	Manufacture of primary aluminium
24.510	Casting of iron
24.520	Casting of steel
24.540	Casting of other non-ferrous metals
25.110	Manufacture of metal structures and parts of structures
25.210	Manufacture of central heating radiators and boilers
25.290	Manufacture of other tanks, reservoirs and containers of metal
25.500	Forging, pressing and roll-forming of metal, and powder metallurgy
25.610	Treatment and coating of metals
25.620	Machining
25.930	Manufacture of wire products, chain and springs
25.990	Manufacture of other fabricated metal products not elsewhere classified
26.510	Manufacture of measuring, testing and navigation instruments
27.110	Manufacture of electric motors, generators and transformers
27.320	Manufacture of other electronic and electric wires and cables
27.900	Manufacture of other electrical equipment
28.210	Manufacture of industrial and laboratory ovens and furnaces, and burners
28.229	Manufacture of other lifting and handling equipment
28.290	Manufacture of other general purpose machinery not elsewhere classified
28.300	Manufacture of agricultural and forestry machinery
28.410	Manufacture of metal forming machinery
28.910	Manufacture of machinery for metallurgy
28.930	Manufacture of machinery for food, beverage and tobacco processing
28.990	Manufacture of other special purpose machinery not elsewhere classified
29.200	Manufacture of bodies and trailers
29.320	Manufacture of other parts and accessories for motor vehicles
31.090	Manufacture of other furniture
32.400	Manufacture of games and toys
32.500	Manufacture of medical and dental instruments and supplies
32.990	Other manufacturing not elsewhere classified
14.390	Manufacture of other knitted and crocheted apparel
24.102	Manufacture of ferro alloys

Building & construction

Code	Title
16.100	Sawing, planing and impregnating of wood
16.210	Manufacture of veneer sheets and other building and furniture boards of wood
16.231	Manufacture of prefabricated buildings
16.232	Manufacture of building articles
16.290	Manufacture of other products of wood, and articles of cork, straw and plaiting materials
20.300	Manufacture of paints, varnishes, printing ink and sealants
22.230	Manufacture of builders' ware of plastic
23.110	Manufacture of flat glass
23.120	Shaping and processing of flat glass
23.510	Manufacture of cement
23.610	Manufacture of concrete products for construction purposes
23.630	Manufacture of ready-mixed concrete
23.690	Manufacture of other articles of concrete, plaster and cement
23.700	Cutting, shaping and finishing of monument and construction stone
24.101	Manufacture of iron and steel
24.330	Cold forming and folding of profiled sheets and sections
25.120	Manufacture of doors and windows of metal
25.720	Manufacture of locks and hinges
27.120	Manufacture of electricity distribution and control apparatus
27.400	Manufacture of electric lighting equipment
28.250	Manufacture of non-domestic cooling and ventilation equipment
28.920	Manufacture of machinery and equipment for mining and construction
31.020	Manufacture of kitchen furniture
33.200	Installation of industrial machinery and equipment
41.101	Housing associations
41.109	Other development and sale of own real estate
41.200	Construction of buildings
42.110	Construction of roads and motorways
42.130	Construction of bridges and tunnels
42.210	Construction of utility projects for fluids
42.220	Construction of utility projects for electricity and telecommunications
42.910	Construction of water projects
42.990	Construction of other civil engineering projects not elsewhere classified
43.110	Demolition of buildings and other structures
43.120	Site preparation
43.210	Electrical installation
43.220	Plumbing, heating and air-conditioning installation
43.290	Other construction installation
43.320	Joinery installation
43.330	Floor and wall covering
43.341	Painting
43.342	Glazing
43.390	Other building completion and finishing
43.911	Tinsmithing
43.919	Other roofing
43.990	Other specialised building and construction
46.130	Agents involved in the sale of timber and building materials
46.473	Wholesale of lighting equipment
46.630	Wholesale of mining, oil and gas production and building and construction machinery and equipment
46.731	Wholesale of timber
46.732	Wholesale of lumber
46.733	Wholesale of paints
46.739	Wholesale of building materials not elsewhere classified
46.740	Wholesale of hardware, plumbing and heating equipment and supplies
47.521	Retail sale of a variety of hardware, paints and other building materials
47.522	Retail sale of hardware
47.523	Retail sale of paints

47.524	Retail sale of lumber
47.529	Retail sale of building materials not elsewhere classified
47.531	Retail sale of wallpaper and floor coverings
68.100	Buying and selling of own real estate
68.201	Renting and operating of housing association real estate
68.209	Other letting of own or leased real estate
68.310	Real estate agencies
68.320	Management of real estate
71.112	Architect services relating to buildings
71.113	Landscape architect services
71.121	Building-related technical consultancy
74.901	Appraisal activities
77.320	Renting and leasing of construction and civil engineering machinery and equipment
81.109	Other combined services incidental to property management

Culture

Code	Title
18.110	Printing of newspapers
18.120	Other printing
18.130	Pre-press and pre-media services
32.120	Manufacture of jewellery and related articles
32.200	Manufacture of musical instruments
46.482	Wholesale of jewellery
47.594	Retail sale of musical instruments and musical scores
47.610	Retail sale of books
47.630	Retail sale of music and video recordings
58.110	Book publishing
58.130	Publishing of newspapers
58.140	Publishing of periodicals and journals
58.190	Other publishing activities
59.110	Motion picture, video and television programme production activities
59.120	Motion picture, video and television programme post-production activities
59.130	Motion picture, video and television programme distribution activities
59.140	Motion picture projection activities
59.200	Sound recording and music publishing activities
60.100	Radio broadcasting
60.200	Television broadcasting
63.910	News agency activities
73.110	Advertising agencies
74.101	Industrial design, product design and other technical design activities
74.102	Graphic and visual communication design
74.103	Interior architecture, interior design and interior consultancy activities
74.200	Photographic activities
74.903	Impresario activities
77.220	Renting of video tapes, DVDs and the like
85.521	Education at municipal school of music and performing arts
85.522	Education in art subjects
85.529	Other cultural education
90.011	Performing artists and entertainment activities in music
90.012	Performing artists and entertainment activities in dramatic art
90.019	Performing artists and entertainment activities not elsewhere classified
90.020	Services incidental to entertainment activities
90.031	Independent artistic activities in visual art
90.032	Independent artistic activities in music
90.033	Independent artistic activities in dramatic art
90.034	Independent artistic activities in literature
90.039	Independent artistic activities not elsewhere classified
90.040	Operation of arts facilities
91.011	Operation of public libraries
91.012	Operation of special and research libraries
91.013	Operation of archives
91.021	Operation of museums of art and decorative art

91.022	Operation of museums of cultural history
91.023	Operation of museums of natural history
91.029	Operation of museums not elsewhere classified
91.030	Operation of historical sites and buildings and similar visitor attractions
91.040	Operation of botanical and zoological gardens and nature reserves
95.250	Repair of watches, clocks and jewellery

Trade

Code	Title
45.111	Agency and wholesale trade of cars and light motor vehicles, except motorcycles
45.112	Retail trade of cars and light motor vehicles, except motorcycles
45.191	Agency and wholesale trade of other motor vehicles, except motorcycles
45.192	Retail trade of other motor vehicles, except motorcycles
45.310	Agency and wholesale trade of parts and accessories for motor vehicles, except motorcycles
45.320	Retail trade of parts and accessories for motor vehicles, except motorcycles
45.402	Retail trade of motorcycles, parts and accessories
46.120	Agents involved in the sale of fuels, ores, metals and industrial chemicals
46.140	Agents involved in the sale of machinery, industrial equipment, ships and aircraft
46.150	Agents involved in the sale of furniture, household goods and hardware
46.160	Agents involved in the sale of textiles, clothing, fur, footwear and leather goods.
46.170	Agents involved in the sale of food, beverages and tobacco
46.180	Agents specialised in the sale of other particular products
46.190	Agents involved in the sale of a variety of goods
46.210	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds
46.220	Wholesale of flowers and plants
46.240	Wholesale of hides, skins and leather
46.310	Wholesale of fruit and vegetables
46.320	Wholesale of meat and meat products
46.330	Wholesale of dairy products, eggs and edible oils and fats
46.341	Wholesale of wine and spirits
46.350	Wholesale of tobacco products
46.360	Wholesale of sugar, chocolate and confectionery
46.370	Wholesale of coffee, tea, cocoa and spices
46.389	Specialised wholesale of a variety of food, beverages and tobacco not elsewhere classified
46.390	Non-specialised wholesale of food, beverages and tobacco
46.410	Wholesale of textiles and soft furnishings
46.421	Wholesale of clothing
46.422	Wholesale of footwear
46.431	Wholesale of electrical household appliances
46.432	Wholesale of radios and televisions
46.433	Wholesale of gramophone records, music and video cassettes, CDs and DVDs
46.435	Wholesale of optical goods
46.441	Wholesale of kitchen equipment, glassware and pottery
46.442	Wholesale of cleaning materials
46.450	Wholesale of perfume and cosmetics
46.460	Wholesale of pharmaceutical goods
46.471	Wholesale of furniture
46.494	Wholesale of sporting equipment
46.495	Wholesale of games and toys
46.499	Wholesale of household goods and goods for personal use not elsewhere classified
46.510	Wholesale of computers, computer peripheral equipment and software
46.520	Wholesale of electronic and telecommunication equipment and parts

46.610 Wholesale of agricultural and forestry machinery and equipment
46.620 Wholesale of machine tools
46.650 Wholesale of office furniture
46.660 Wholesale of other office machinery and equipment
46.691 Wholesale of machinery and equipment for electricity generation and installation
46.693 Wholesale of other industrial machinery and equipment
46.694 Wholesale of other machinery and equipment for trade, transport and services
46.710 Wholesale of fuels
46.720 Wholesale of metals and metal ores
46.750 Wholesale of chemical products
46.761 Wholesale of paper and cardboard
46.769 Wholesale of other intermediate products not elsewhere classified
46.770 Wholesale of waste and scrap
46.900 Non-specialised wholesale trade
47.111 Retail sale in non-specialised stores with food, beverages and tobacco predominating
47.112 Retail sale in non-specialised kiosks with food, beverages and tobacco predominating
47.190 Other retail sale in non-specialised stores
47.220 Retail sale of meat and meat products
47.230 Retail sale of fish, shellfish and molluscs
47.241 Retail sale of bakery products
47.242 Retail sale of sugar confectionery
47.251 Retail sale of wine and spirits
47.259 Retail sale of other beverages
47.291 Retail sale of health foods
47.292 Retail sale of coffee and tea
47.299 Retail sale of food, beverages and tobacco not elsewhere classified
47.300 Retail sale of automotive fuel
47.410 Retail sale of computers and computer equipment
47.420 Retail sale of telecommunications equipment
47.430 Retail sale of audio and video equipment
47.510 Retail sale of textiles and soft furnishings
47.533 Retail sale of curtains
47.540 Retail sale of electrical household appliances
47.591 Retail sale of furniture
47.591 Retail sale of lighting equipment
47.593 Retail sale of kitchen equipment, glassware and pottery
47.599 Retail sale of household furnishing articles not elsewhere classified
47.620 Retail sale of newspapers and stationery
47.641 Retail sale of sporting equipment
47.650 Retail sale of games and toys
47.710 Retail sale of clothing
47.721 Retail sale of footwear
47.722 Retail sale of travel accessories made of leather and leather substitutes and leather goods
47.730 Retail sale of pharmaceutical goods
47.740 Retail sale of medical and orthopaedic goods
47.750 Retail sale of cosmetic and toilet articles
47.761 Retail sale of flowers and plants
47.762 Retail sale of pets and pet food
47.771 Retail sale of watches and clocks
47.772 Retail sale of jewellery
47.781 Retail sale of photographic equipment
47.782 Retail sale of optical goods
47.789 Retail sale not elsewhere classified
47.799 Retail sale of other second-hand goods
47.810 Retail sale via stalls and markets of food, beverages and tobacco products
47.911 Non-specialised retail sale via mail order or Internet
47.912 Sale via mail order or Internet of textiles, soft furnishings, clothing, footwear, travel accessories and leather goods
47.914 Sale via mail order or Internet of electrical household appliances, radios, televisions, gramophone records, cassettes and musical instruments

47.916 Sale via mail order or Internet of ICT equipment
47.917 Sale via mail order or Internet of health foods
47.919 Other specialised sale via mail order or Internet
47.990 Other retail sale not in stores, stalls or markets

Transport and logistics

Code	Title
49.200	Freight rail transport
49.410	Freight transport by road
51.210	Freight air transport
52.100	Warehousing and storage
52.211	Operation of rail freight terminals
52.219	Other service activities incidental to land transportation
52.240	Loading and unloading
52.291	Forwarding agencies
52.299	Other transport agency services

KIBS

Code	Title
21.100	Manufacture of basic pharmaceutical products
21.200	Manufacture of pharmaceutical preparations
26.300	Manufacture of communication equipment
62.010	Programming services
62.020	Information technology consultancy services
62.090	Other information technology service activities
69.100	Legal services
69.203	Tax consultancy
70.210	Public relations and communication activities
70.220	Business and other administrative consultancy
71.129	Other technical consulting activities
71.200	Technical testing and analysis
72.110	Research and development on biotechnology
72.190	Other research and development on natural sciences and engineering
72.200	Research and development on social sciences and humanities
82.910	Debt collection and credit rating activities

Financial industry

Code	Title
64.190	Other banking activities
64.201	Financial holding companies
64.302	Investment companies/funds open to the public
64.304	Taxable investment companies
64.306	Private equity funds
64.309	Other security management
64.920	Other credit granting
65.110	Life insurance
65.120	Non-life insurance
65.300	Pension funding
66.110	Administration of financial markets
66.120	Security brokerage
66.190	Other activities auxiliary to financial services
66.220	Activities of insurance agents and brokers
66.290	Other activities auxiliary to insurance and pension funding

Miscellaneous

Code	Title
01.xxx	Agriculture and services incidental to agriculture, hunting and game management
02.xxx	Forestry and services incidental to forestry
10.850	Manufacture of prepared meals and dishes
26.110	Manufacture of electronic components
33.110	Repair of fabricated metal products
33.120	Repair of machinery
33.130	Repair of electronic and optical equipment
33.140	Repair of electrical equipment

33.160	Repair and maintenance of aircraft and spacecraft	82.190	Photocopying, document preparation and other specialised office services
33.170	Repair and maintenance of other means of transport	82.201	Call centres
33.190	Repair of other equipment	82.202	Telesales
35.220	Distribution of gaseous fuels through mains	82.920	Packaging activities
36.000	Water collection, treatment and supply	82.990	Other business support services not elsewhere classified
37.000	Sewerage	84.110	General public administration activities
38.120	Collection of hazardous waste	84.120	Public administration in connection with healthcare, social services, education, church, culture and environmental protection
38.210	Treatment and disposal of non-hazardous waste	84.130	Public administration in connection with business and labour market
38.220	Treatment and disposal of hazardous waste	84.250	Fire service activities
38.310	Dismantling of wrecks	85.xxx	Education
38.320	Sorting and processing of waste for recycling	86.102	Special hospitals, except psychiatric
39.000	Remediation and similar activities	86.104	Adult mental health institutions
45.200	Maintenance and repair of motor vehicles, except motor cycles	86.105	Mental health institutions for children and young people
45.403	Maintenance and repair of motor cycles	86.106	Drug and alcohol rehabilitation centres
49.200	Passenger rail transport	86.107	Physical rehabilitation centres
49.311	Bus transport in urban and suburban areas	86.211	General medical practice services
49.320	Taxi operation	86.212	Outpatient clinics, except psychiatric
49.391	Bus transport outside urban and suburban areas	86.221	Specialised medical services, except psychiatric
49.420	Removal services	86.222	Mental health services
52.212	Operation of car parks	86.224	Psychiatric outpatient clinics for children and young people
52.213	Operation of toll booths	86.230	Dental practice services
52.214	Operation of taxi control centres and other passenger transport agency services	86.901	Home nursing
52.222	Rescue services	86.902	Physiotherapy services
52.230	Other services incidental to air transport	86.904	Other preventive health services
52.293	Air brokerage	86.905	Clinical psychologist services
53.xxx	Postal and distribution activities	86.906	Medical laboratory services
56.102	Operation of takeaways	86.907	Ambulance service
56.210	Catering activities	86.909	Other health services
56.290	Canteens operated as an independent enterprise	87.101	Special nursing homes, except psychiatric
58.120	Publishing of directories and mailing lists	87.102	Nursing homes, except psychiatric
58.290	Other software publishing	87.202	Residential care for drug and alcohol addiction
61.xxx	Telecommunications	87.203	Group homes for people with learning disabilities
62.030	Management and operation of IT systems	87.301	Residential care for the elderly
63.110	Data processing, hosting and related services	87.302	Group homes for the elderly and disabled staffed around the clock by permanent staff
63.120	Operation of web portals	87.303	Group homes for the elderly and disabled staffed at certain times of day by permanent staff
63.990	Other information service activities not elsewhere classified	87.304	Respite care homes
64.202	Special holding companies	87.305	Residential care homes for children
64.303	Portfolio investment companies	87.901	Child protection institutions
64.990	Other financing activities not elsewhere classified	87.909	Other care institutions
69.201	Accounting and bookkeeping	88.xxx	Social work activities without accommodation
69.202	Auditing	92.000	Lottery and totalisator games
73.120	Media representation	93.110	Operation of sports facilities
73.200	Market surveys and opinion polls	93.120	Sports clubs
74.300	Translation and interpretation activities	93.130	Fitness facilities
74.902	Modelling agencies	93.190	Other sporting activities
74.909	Other professional, scientific and technical activities not elsewhere classified	94.xxx	Activities in member organisations
75.000	Veterinary activities	95.110	Repair of computers and peripheral equipment
77.110	Renting and leasing of cars and other light motor vehicles	95.120	Repair of communication equipment
77.120	Renting and leasing of trucks	95.210	Repair of consumer electronics
77.210	Renting and leasing of recreational and sports goods	95.220	Repair of household appliances and garden equipment
77.290	Renting and leasing of other household goods for personal use	95.230	Repair of footwear and leather goods
77.310	Renting and leasing of agricultural machinery and equipment	95.240	Repair of furniture and home furnishings
77.330	Renting and leasing of office machinery and computers	95.290	Repair of other personal and household goods
77.350	Renting and leasing of air transport equipment	96.xxx	Other personal services
77.390	Renting and leasing of other machinery, equipment and tangible goods not elsewhere classified	97.000	Paid work in private households
77.400	Leasing of intellectual property and similar products, except copyrighted works		
78.xxx	Employment services		
80.xxx	Private security services and investigation		
81.101	Caretaker services		
81.210	Cleaning of buildings		
81.220	External cleaning of buildings and industrial cleaning		
81.291	Pest control		
81.299	Other cleaning activities not elsewhere classified		
81.300	Planting of gardens and parks		
82.110	Combined office services		

Appendix 6: Areas

Municipality	Classification in knowledge-gathering project	STN * not included in Angell et al. (2014)	Municipality	Classification in knowledge-gathering project	STN * not included in Angell et al. (2014)
1804 Bodø	1 Salten		1915 Bjarkøy	5 Sør-Troms	
1805 Narvik	2 Ofoten	STN*	1917 Ibestad	5 Sør-Troms	
1811 Bindal	3 Helgeland		1919 Gratangen	5 Sør-Troms	STN
1812 Sømna	3 Helgeland		1920 Lavangen	5 Sør-Troms	STN
1813 Brønnøy	3 Helgeland		1922 Bardu	7 Midt-Troms	
1815 Vega	3 Helgeland		1923 Salangen	5 Sør-Troms	STN*
1816 Vevelstad	3 Helgeland		1924 Målselv	7 Midt-Troms	
1818 Herøy (Nordl.)	3 Helgeland		1925 Sørreisa	7 Midt-Troms	STN
1820 Alstahaug	3 Helgeland		1926 Dyrøy	7 Midt-Troms	
1822 Leirfjord	3 Helgeland		1927 Tranøy	7 Midt-Troms	
1824 Vefsn	3 Helgeland		1928 Torsken	7 Midt-Troms	
1825 Grane	3 Helgeland		1929 Berg	7 Midt-Troms	
1826 Hattfjelldal	3 Helgeland		1931 Lenvik	7 Midt-Troms	
1827 Dønna	3 Helgeland		1933 Balsfjord	6 Tromsø	STN*
1828 Nesna	3 Helgeland		1936 Karlsøy	6 Tromsø	STN*
1832 Hemnes	3 Helgeland		1938 Lyngen	8 Nord-Troms	STN
1833 Rana	3 Helgeland		1939 Storfjord	8 Nord-Troms	STN
1834 Lurøy	3 Helgeland		1940 Gáivuotna Kåfjord	8 Nord-Troms	STN
1835 Træna	3 Helgeland		1941 Skjervøy	8 Nord-Troms	STN*
1836 Rødøy	1 Salten		1942 Nordreisa	8 Nord-Troms	STN*
1837 Meløy	1 Salten		1943 Kvæangen	8 Nord-Troms	STN
1838 Gildeskål	1 Salten		2002 Vardø	9 Øst-Finnmark	STN*
1839 Beiarn	1 Salten		2003 Vadsø	9 Øst-Finnmark	STN*
1840 Saltdal	1 Salten		2004 Hammerfest	10 Vest-Finnmark	STN*
1841 Fauske	1 Salten		2011 Guovdageaidnu Kautokeino	11 Indre Finnmark	STN
1845 Sørfold	1 Salten		2012 Alta	10 Vest-Finnmark	STN*
1848 Steigen	1 Salten		2014 Loppa	10 Vest-Finnmark	STN
1849 Hamarøy	1 Salten	STN	2015 Hasvik	10 Vest-Finnmark	STN*
1850 Tysfjord	2 Ofoten	STN	2017 Kvalsund	10 Vest-Finnmark	STN
1851 Lødingen	2 Ofoten		2018 Måsøy	10 Vest-Finnmark	STN
1852 Tjeldsund	2 Ofoten		2019 Nordkapp	10 Vest-Finnmark	STN
1853 Evenes	2 Ofoten	STN	2020 Porsanger Porsángu Porsanki	11 Indre Finnmark	STN
1854 Ballangen	2 Ofoten		2021 Kárášjohka Karasjok	11 Indre Finnmark	STN
1856 Røst	4 Lofoten/Vesterålen		2022 Lebesby	9 Øst-Finnmark	STN
1857 Værøy	4 Lofoten/Vesterålen		2023 Gamvik	9 Øst-Finnmark	STN
1859 Flakstad	4 Lofoten/Vesterålen		2024 Berlevåg	9 Øst-Finnmark	STN*
1860 Vestvågøy	4 Lofoten/Vesterålen		2025 Deatnu Tana	9 Øst-Finnmark	STN
1865 Vågan	4 Lofoten/Vesterålen		2027 Unjárga Nesseby	9 Øst-Finnmark	STN
1866 Hadsel	4 Lofoten/Vesterålen		2028 Båtsfjord	9 Øst-Finnmark	STN
1867 Bø (Nordl.)	4 Lofoten/Vesterålen		2030 Sør-Varanger	9 Øst-Finnmark	STN*
1868 Øksnes	4 Lofoten/Vesterålen				
1870 Sortland	4 Lofoten/Vesterålen				
1871 Andøy	4 Lofoten/Vesterålen				
1874 Moskenes	4 Lofoten/Vesterålen				
1901 Harstad	5 Sør-Troms				
1902 Tromsø	6 Tromsø				
1911 Kvæfjord	5 Sør-Troms				
1913 Skånland	5 Sør-Troms	STN			