


Ilari Aula • Rannveig Amundsen • Paul Buvarp • Omar Harrami •
Johan Lindgren • Viktoria Sahlén • Christoffer Wedebrand

Critical Nordic Flows



Collaboration between Finland, Norway
and Sweden on Security of Supply and
Critical Infrastructure Protection

Commissioned by the Finnish National Emergency Supply Agency; the Norwegian Ministry of Trade, Industry and Fisheries; and the Swedish Civil Contingencies Agency.

Research input provided by the Finnish National Emergency Supply Agency; the Norwegian Defence Research Establishment; and the Swedish Defence Research Agency.

Publisher: National Emergency Supply Agency, Helsinki, 2020

Graphic design: Inka Kosonen

Photos: NESAs, Colourbox

ISBN 978-952-5608-75-5 (digital)

ISBN 978-952-5608-74-8 (print)

MSB1524 - March 2020

Executive summary

In October 2017, a tripartite seminar held in Helsinki concluded that there appear to be sound justifications for continuing and, as appropriate, deepening cooperation between Finland, Norway and Sweden on the themes of security of supply and critical infrastructure protection. This report provides an initial response to the seminar diagnosis by exploring the ways in which Finland, Norway and Sweden could deepen their trilateral cooperation to prepare for potential disruptions to cross-border flows of critical goods and services.

The six societal sectors addressed in this report are communications and digital networks, energy, food, financial infrastructure, pharmaceuticals, and transport. The findings are based on an analysis of publicly available documents and over 60 interviews with public and private sector experts across Finland, Norway and Sweden. The report does not provide an exhaustive overview. Instead, it aims to facilitate further research and joint projects by providing a bird's eye view of the key cooperation arrangements in which the three countries are currently involved.

This report identifies several opportunities for further trilateral collaboration. Finland, Norway and Sweden share similar challenges in protecting vital digital solutions and services, and the supply of essential pharmaceuticals. In other areas, the countries' emphases and starting points vary. Despite their differing energy mixes, a shift towards new energy sources and systems calls for coordinated efforts to ensure energy security across the three countries. In terms of transport, Finland and Sweden are more exposed than Norway to disruptions to vital cross-border cargo flows in the Baltic Sea, while in securing payment systems, Finland's reliance on European infrastructure distinguishes the country from its western neighbours. In ensuring food security, the three countries have largely relied on their own, national measures.

In working together to address cross-border dependencies, the countries could benefit from pursuing cross-sectoral combinations of measures. To help develop new associations, this report categorises measures into four types: joint research, platform revision, regulatory harmonisation, and cross-border policy coherence. The countries could also strive towards a shared understanding of the levels of international collaboration on which specific challenges are best tackled. In some cases, the three countries may find it useful to develop their existing bilateral arrangements and agreements on a bilateral or trilateral basis, whereas some challenges are better tackled by pursuing joint measures with the Nordic and the Baltic countries. Yet on other issues trilateral collaboration could involve agreeing on the themes to be pursued at EU and NATO level, two major institutions to which the countries are varyingly affiliated.

By compiling a total of 28 provisional themes for further cooperation, the final report serves as a discussion paper for policy-makers and experts. Throughout, it points towards cross-sectoral thinking as a key to deeper collaboration between Finland, Norway and Sweden in the security of supply and critical infrastructure protection. While in individual areas, the countries' perceived interests sometimes differ, combining initiatives, projects and agreements across borders, as well as involving companies and other societal stakeholders in the process, can result in new arrangements that benefit all parties. The countries' ties are traditionally deep and barriers to cooperation low. As long as the right policy combinations are found, trilateral cooperation can serve as a vital component in their preparedness efforts.

Contents

1 Introduction 6	2 Communication and digital networks 14
3 Energy 26	4 Financial infrastructure 36
5 Food 46	6 Pharmaceuticals 54
7 Transport 62	8 Conclusion 72
X Sources 76	

List of figures

Figure 1: Submarine cables, 2020 16	Figure 2: Use of cloud computing services by enterprises, % of enterprises, 2018. 23	Figure 3: Electricity generation, 2018 28	Figure 4: Indigenous production of energy, 1000 tonnes oil equivalents, 2016 35
Figure 5: Participants in the large value payment system RIX 40	Figure 6: Cash as share of total money supply (M1), 2012–2017 42	Figure 7: Annual decrease in cash as share of total money supply (M1), 2013–2017 42	Figure 8: Aquaculture production, tonnes of live weight, 2017 49
Figure 9: Arable land and gardens, square kilometres, 2016 53	Figure 10: Medicine shortage notifications from marketing authorisation holders to the Finnish Medicines Agency, 2010–2019 56	Figure 11: Gross weight of seaborne freight handled in all ports, in tonnes per inhabitant, 2017 65	Figure 12: Swedish goods transport, 2018 68

1

Introduction

Context

In October 2017, a tripartite seminar held in Helsinki concluded that there appear to be sound justifications for continuing and, as appropriate, deepening trilateral cooperation between Finland, Norway and Sweden on the themes of security of supply and critical infrastructure protection. One of the operational conclusions reached was that the cooperation between the countries could benefit from strengthening of the common information base through a mapping and analysis of cross-border interdependencies and of flows of strategic goods and products in the Nordic region.

This report provides an initial response to the seminar diagnosis. Commissioned by three public agencies, the Finnish National Emergency Supply Agency (NESA), the Norwegian Ministry of Trade, Industry and Fisheries (NFD), and the Swedish Civil Contingencies Agency (MSB), it explores the extent to which the cooperation arrangements in place between Finland, Norway and Sweden help the countries prepare for potential disruptions in cross-border flows of critical goods and services. The research was led by a project manager based at the NESA, and conducted together with experts at the commissioning agencies and researchers from two institutes: the Swedish Defence Research Agency (FOI) and the Norwegian Defence Research Establishment (FFI). The project was designed to provide a bird's eye view of the diverse cooperation arrangements and critical flows in which the three countries are involved, and to serve as a starting point for further, trilateral research projects and concrete collaborative arrangements.

This report is not the first endeavour to identify the issues, trends and processes in the shifting international landscape to which these Nordic countries could find it beneficial to respond together. The need for an enhanced collective understanding of countries' shared flows and dependencies has long been recognised. However, the changing geopolitical

environment, hybrid and cyber threats, the globalisation of supply chains, and climate change, are just some of the factors creating a need for higher situational awareness. The civilian elements of national preparedness efforts, on which this report focuses, are significantly affected by such changes. They have motivated Finland, Norway and Sweden to reassess the instances in which the three countries could best prevent and mitigate potential disruptions to critical societal functions by acting together.

Design

This report aims to help the reader understand how Finland, Norway and Sweden can utilise the symmetries and asymmetries between their dependencies on international flows of goods, products and services to collectively strengthen their security of supply and critical infrastructure protection. To do so, it compiles i) existing forms of cooperation between the countries, ii) flows and dependencies between and shared by them, and iii) opportunities for further cooperation through which the countries could better thrive amidst the increasing and deepening connections transcending national boundaries. The six societal sectors addressed in this final report parallel the institutional tasks of the three commissioning agencies, which set the initial limits for the exploration work. As the research progressed, the researchers focused on those themes in each sector, which had been diagnosed in collective meetings as showing the most potential for trilateral cooperation.¹

The data was compiled by a research group consisting of Finnish, Norwegian and Swedish research-

¹ The initial scope included communications and cyber networks, energy, financial market infrastructures, food and water, pharmaceuticals, and transport.

ers working in and for the commissioning agencies between March 2019 and January 2020 in each country. The first element of the data-gathering was documentary research, as the researchers amassed existing literature, reports and articles available in their respective countries. The second element was to conduct over 60 interviews with public and private sector experts. While the guides for semi-structured interviews were agreed on beforehand, the interviews were conducted at different times and by different researchers in each country, with the majority in Finland. Through internal seminars and correspondence, the research team steered and complemented the data-gathering to generate information conducive to a joint analysis. The country-specific sections in this report remain somewhat independent wholes, highlighting those aspects that emanated from country-specific research.

The aim of interviewing public sector experts, whose work involves security of supply and critical infrastructure protection, was to draw on their informed views on the current state of official cooperation, on their sense for potential trends affecting prospects for further cooperation, and on their ideas regarding future cooperation schemes, without them representing the official views of their employers. The experts were also asked to identify companies important for their country's preparedness efforts, and which they deemed as potentially relevant for the project. Companies play a substantial role in maintaining critical societal functions in the Nordic countries; an important part of national preparedness efforts is to ensure that they can continue their operations even during shortages, disruptions and other exceptional circumstances.² The aim of interviewing private sector experts in companies and industry associations was to draw directly on their continuity management, supply risk analysis and contingency planning efforts to help identify the kinds of flows and dependencies potentially important to preparedness cooperation between Finland, Norway and Sweden.

As inevitable in all policy-driven research, the process of analysing the data involves a subjective element: interviewees' interests flow into the views they posit, and researchers interpret new information based on their previous dispositions. Iterative

2 Aaltola, Mika et al (2014): Towards the geopolitics of flows, 170–176.

writing and wide comment rounds were utilised to ensure that the research process remained transparent and balanced.³ Besides online correspondence and facilitative meetings, the research team met several times to discuss the interim findings. The full draft was subjected to a review by public sector experts in each country between December 2019 and January 2020. The research team conducted iterative writing before, during and after the comment rounds to accommodate and balance the many perspectives. By themselves, the comment rounds served to further cross-border collaboration, enabling the national experts to engage with each other's views and the research team to nuance the analysis.

The research design is widely defined as exploratory, as it aims to 'generate new ideas and weave them together to form grounded theory, or theory that emerges directly from data'.⁴ In social sciences, exploratory design has been most conventionally applied in sociological research, but has over time found new forms in other disciplines. The exploratory design is useful in situations in which gaps in current knowledge are not precisely identified and there is a need to take stock of the current body of knowledge in order to find its limits. Such research is usually carried out in the early stages of a research programme to help tease out more specific hypotheses, to 'find' rather than 'resolve' problems, that is, to identify new areas subsequent research may pore into over tailored tools. Serendipities, or fortunate discoveries, are a potential product of such a research format, which, in the context of this report, may materialise as new perspectives on trilateral cooperation, or an updated perspective on its current status.⁵

The exploratory approach does not strive to exhaust the topic, and stones left unturned have been duly noted during the research process. Some important sectors, such as those related to military materiel, rescue services, governmental commu-

3 Dreyer, Iana and Gerald Stang (2013): 'Foresight in governments – practices and trends around the world' in EUISS (2013): Yearbook for European Security.

4 Stebbins, Robert A. (2001): Exploratory Research in the Social Sciences; Glaser, Barney and Anselm Strauss (1967): The Discovery of Grounded Theory: Strategies for Qualitative Research.

5 Swedberg, Richard (2018): 'On the Uses of Exploratory Research and Exploratory Studies in Social Science' in Elman, Colin, John Gerring and James Mahoney (eds.) (forthcoming): The Production of Knowledge.

nications and critical raw materials, were excluded from the onset. The research inevitably involved leaving out some potential areas in order to compile enough information on the ones included, whereby potential venues for cooperation have gone unregistered. Furthermore, in order to retain the confidentiality of the companies' business arrangements and the states' preparedness efforts, the report avoids sector-specific details. The Finnish, Norwegian and Swedish authorities have the opportunity to use the material accrued to prepare versions for limited use. Steps for further research are also flagged. One direction for a follow-up would be to invite other countries, in particular Denmark, Iceland and the Baltic states, to generate new insights on regional cooperation.

These caveats aside, the report aims to provide a useful lens for policy-makers and experts in Finland, Norway and Sweden to evaluate the potential policy trajectories by compiling, curating and evaluating knowledge on civilian preparedness efforts currently scattered across various public and private actors. The research supports evidence-based policy-making in two ways. First, investigations on security of supply are often conducted by and for individual countries. This report builds on a collaborative analysis by public agencies and research institutions in three Nordic states. Second, investigations often focus on one sector at a time, such as agriculture or logistics. By addressing several sectors, the report creates some initial space for new associations across them, thus serving the need for a cross-sectoral perspective that policy-makers and analysts have identified.⁶

Concepts

For sake of convenience, in this report the concept of the 'Nordic' encompasses Finland, Norway and Sweden, unless otherwise indicated as referring to Denmark, Finland, Iceland, Norway and Sweden and their associated territories. Four concepts central to the report require further elaboration. First, whereas in a continental context security of supply is under-

6 European Commission (2019): Evaluation of Council Directive 2008/114 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection; Clemente, Dave (2013): Cyber security and global interdependence: What is critical?

stood as the availability of a given product, function or service, in this report the concept refers broadly to the policy area to:

*ensure the continuity of production and infrastructure vital to society under all circumstances in such a way that the living conditions of the population and the critical functions of society are secured also in the event of disruptions and emergencies, including a state of defence.*⁷

The scope of this formulation is wide, resonating with various themes that Finland, Norway and Sweden advance in their preparedness efforts.⁸ In Finland, security of supply is closely interwoven with the concept of comprehensive security, a cooperation model in which the authorities, businesses, organisations and citizens work together in safeguarding the vital functions of society against a wide range of challenges, such as natural hazards, pandemics and shortages.⁹ In Sweden, security of supply is a fundamental part both of society's crisis preparedness and the nation's civil defence planning. The Swedish concept of total defence includes preparations and planning carried out by civil and military defence in order to prepare Sweden for heightened alert and war.¹⁰ All government authorities are responsible for ensuring the functioning of the activities in their own field under heightened preparedness in cooperation with all relevant actors, such as national authorities, municipalities, county councils, associations, and private businesses.¹¹ In Norway, security of supply also overlaps with the concept of total defence. The Norwegian concept emphasises the importance of mutual support and cooperation between the armed forces and civil society in addressing public security as well as civil protection.¹² As NATO membership is a key element of Norwegian security and defence policy, many functions related to security of supply take

7 NESAs (2019a): Objectives.

8 Aaltola et al (2014), 170; MSB (2016a): Försörjningssäkerhet i andra länder – En kunskapsöversikt.

9 Security Committee (2017): The security strategy for society.

10 Sweden (1992): Lag (1992:1403) om totalförsvar och höjd beredskap.

11 Sweden (2015a): Förordning (2015:1053, 4 §) om totalförsvar och höjd beredskap; Swedish Ministry of Defence and Ministry of Justice (2018): Development of modern total defence.

12 Norwegian Ministry of Justice and Public Security & Norwegian Ministry of Defence (2018): Support and Cooperation: A description of the total defence in Norway.

place in cooperation with the Allied nations.¹³

Second, the report discusses *critical infrastructure*, which as per the European Union Directive refers to

*an asset, system or part thereof located in Member States which is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which would have a significant impact in a Member State as a result of the failure to maintain those functions.*¹⁴

The EU and the OECD have stepped up measures to identify such critical infrastructure elements and enhance prevention, preparedness and consequence management measures in relation to them.¹⁵ Inter-governmental work has been recognised as crucial, because much of the nationally important infrastructure, such as maritime cables, pharmaceutical factories and data centres, often lie beyond national boundaries.¹⁶ Accordingly, and third, the report refers to *critical flows* to highlight the international nature of such critical infrastructure in modern Nordic societies. The concept of flows helps conceptualise phenomena of social and political importance without holding state boundaries as a fixed limit to the analysis. The paradigm of 'flow security' has been invoked alongside more conventional 'territorial' security to recognise that political, economic and societal functions nationally identified as critical stretch across borders.¹⁷ Critical global flows are 'transboundary arteries that constitute the essence of open societies, daily communications and the global economy', and they have different character-

istics, which in turn give birth to dependencies.¹⁸

Fourth, critical flows imply *dependencies* between states, companies, non-governmental organisations and individuals.¹⁹ Asymmetrical interdependencies in the security of supply and critical infrastructure have security implications: while they can be mutually beneficial, governments still usually treat them as vulnerabilities to be mitigated, as they allow other actors to take advantage of new disruptive practices and sources of power.²⁰ Gaining a better understanding of the current dependencies between and shared by the Nordic countries is a step towards ensuring that crucial connections are hard to exploit, disrupt or sever, either by intention, by accident, or by chance.

Structure

This report has six sectoral chapters. First, each presents, country by country, sectoral characteristics highlighted during the research process, and the main arrangements the countries have in place to prevent and mitigate any potential disruptions to important societal functions. The country-specific sections do not cover identical issues. Each chapter then discusses the current state of and the prospects for further cooperation. The provisional suggestions compiled at the end of each chapter illustrate the diversity of measures that the three countries may choose to develop rather than form the main thrust of this report. Here, references to interviews indicate the themes addressed rather than direct proposals or views articulated by interviewees. The themes provide raw material for policy-makers and sectoral experts to make use of when thinking about the next steps.

The conclusive chapter draws together three perspectives for orienting those steps. Throughout, this report underlines the compiling of cross-sectoral

13 *ibid.*, 27; Nyhamar, Tore (2019): A future Nordic alliance? – prerequisites and possible operations, 13–14.

14 European Council (2008): Council Directive 2008/114/EC on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection.

15 OECD (2019a): Good governance for critical infrastructure resilience.

16 European Commission (2013): Commission staff working document on a new approach to the European Programme for Critical Infrastructure Protection Making European Critical Infrastructure more secure.

17 Aaltola et al (2014); Wimmer, Andreas and Nina Glick Schiller (2002): 'Methodological Nationalism and Beyond: Nation-state Building, Migration and the Social Sciences' in *Global Networks*, 2(4).

18 Brattberg, Erik & Daniel Hamilton (2014): 'Introduction' in Brattberg, Erik & Daniel Hamilton (eds.): *Global Flow Security: A New Security Agenda for the Transatlantic Community in 2030*, vi; Ries, Tomas (2014): 'Global Flow Security: A Conceptual Framework' in Brattberg, Erik & Daniel Hamilton (eds.) (2014).

19 Keohane, Robert and Joseph Nye (2012): *Power and interdependence*.

20 Fjäder, Christian (2019): 'Interdependence as dependence: economic security in the age of global interconnectedness' in Wigell, Mikael, Sören Scholvin and Mika Aaltola (eds.): *Geo-economics and power politics in the 21st century*.

Throughout, this report underlines the compiling of cross-sectoral packages as a key to transcending the countries' sometimes diverging emphases and interests.

packages as a key to transcending the countries' sometimes diverging emphases and interests. One useful angle for further collaboration is to try identify the sectors in which the countries have similar aspirations, and to search across the sectors if such areas are hard to find. This report highlights the countries' shared challenges in ensuring the supply of essential pharmaceuticals, and in responding to novel threats faced by highly digitalised societies. Maintaining the countries' energy security amidst a shift towards new energy sources and systems, protecting vital cross-border cargo flows, and monitoring the functioning of the financial infrastructures, are also venues for potential collaboration, as long as the arrangements can accommodate the countries' somewhat diverging priorities and starting points. Furthermore, although the countries have largely relied on independent measures, they could potentially improve the exchange of best practices and formalise some of the current cooperative arrangements to ensure food security.

Another approach to complement attempts to deepen cooperation in individual sectors is to pursue similar types of measures across them. Several suggestions included to this report bear similarities to each other, and here they are divided into four groups. One group consists of joint studies and explorations, which can deepen the general level of analysis in this report. Another group includes ways to harness or strengthen existing collaborative platforms, as well as to create completely new ones. A third group constitutes measures to harmonise the regulatory environment in order to ease the sharing and trade of vital goods and other resources during disruptions. And a fourth group involves more wide-ranging calls for policy coherence across the borders to ensure that national strategies in different societal sectors reflect the security of supply and critical infrastructure protection needs across the three countries.

A third angle to rethinking trilateral cooperation is to work together to consider the ways different levels of international collaboration can be best used to address commonly recognised issues. Currently, Finland, Norway and Sweden have bilateral, although varying active agreements on economic co-operation with each other to ensure that the countries provide each other with vital goods

and materials during international crises.²¹ Some challenges involved with cross-border flows and dependencies may be tackled if such arrangements are revamped on a bilateral or trilateral basis. However, other issues are rooted in phenomena beyond the joint means of the three countries, and other states also may have an interest in addressing them. In these cases, a regional approach involving the five Nordic countries and the Baltic countries may yield an effective response. Other phenomena are such in nature that the most important form of trilateral cooperation may be to pursue commonly agreed action points in the EU and the NATO. Finland is an EU Member State using the common currency of the euro. Sweden is an EU, though non-euro Member State. Norway is not an EU Member State, but a close collaborator through the EEA agreement. Norway is a member of NATO, whereas Finland and Sweden have looser ties to NATO through the Euro-Atlantic Partnership Council (EAPC). These differing affiliations can be used to pursue a shared agenda on international fronts.

Through its exploratory approach, and by bringing some organisational clarity to the manifold collaborative arrangements Finland, Norway and Sweden currently have, this report aims to start the discussion on the potential next steps. Cross-sectoral thinking is a key to deeper collaboration between the three countries in the security of supply and critical infrastructure protection. While in individual sectors, the countries' perceived interests sometimes differ, wrapping together initiatives, projects and agreements across the sectors, while involving companies and other societally important stakeholders in the process, can result in new arrangements that benefit all parties.

²¹ Norway-Finland (2006): Avtale mellom Norge og Finland om opprettholdelse av vare- og tjenestebyttet i krigs- og krisesituasjoner; Finland-Sweden (1992): Sopimus Suomen ja Ruotsin välisestä taloudellisesta yhteistyöstä kansainvälisissä kriisitilanteissa; Sweden-Norway (1986): Protokoll om handel mellan Sverige och Norge i internationella krislägen.

Cross-sectoral thinking is a key to deeper collaboration between the three countries in the security of supply and critical infrastructure protection.

2

Communication and digital networks

Countries

FINLAND

Finland is a thoroughly digitalised society: alongside the other four Nordic countries, it tops the rankings in the connectivity speeds and mobile data usage, and in the general capability of the private and public sector to take advantage of big data and other digital assets.²² This section centres on its key cross-border communications infrastructure, both physical and digital, emphasising cyber security as a rising theme.

The backbone of the Finnish communications networks lies in the Baltic Sea: data and phone calls between Finland and the rest of the world are channelled abroad primarily through submarine optic fibre cables (figure 1). The submarine cables link Finland through Estonia, Sweden and Germany to major data hubs in continental Europe, such as Amsterdam, Frankfurt and London. While Finnish private and public actors also make use of satellites to transmit information and to provide positioning

services, satellite connections are not enough to carry the information flows channelled through submarine cables.²³

Telecommunications companies make use of the submarine cables to provide Finnish companies, organisations and individuals with connectivity services. Together, Elisa, DNA and Telia control a significant share of the markets, facilitating 4G coverage throughout the country. Two of the companies are characteristically Nordic: Telia is a major provider of mobile, broadband, fixed voice and TV services in Finland, Sweden and Norway, and is partly owned by the Swedish state, whereas DNA is wholly owned by Telenor, a Norwegian state-owned telecoms company.²⁴ The companies have built nation-wide and competing, although partially overlapping, communication networks. The Finnish private sector has strong expertise in building the necessary infrastructure, for instance due to Nokia's strong presence in network equipment manufacturing.

²³ Interview at a telecommunications provider, Finland, 14 August.

²⁴ Throughout the report, state-owned enterprises (SOEs) includes both majority-owned and fully owned SOEs. OECD (2018): Ownership and governance of state-owned enterprises: A compendium of national practices; Telia (2018): Market and Brands; Telenor (2019): Tender offer for sales in DNA PLC.

²² Ali-Yrkkö, Jyrki et al (2019): Digibarometri 2019: Digi tulee, mutta riittävätkö resurssit?

OVERVIEW

Finland, Norway and Sweden are global forerunners in adopting new digital services.²⁵ While digitalisation is an invaluable social asset in many ways, the process also creates new dependencies in everyday functions pivotal to governments, companies and individuals. Digitalisation makes

many critical assets increasingly reliant on information flows across national borders.²⁶ New technologies, such as cloud-based services and 5G networks, require specialised software and expertise often located or originating from abroad. As power plants, health centres and other societally im-

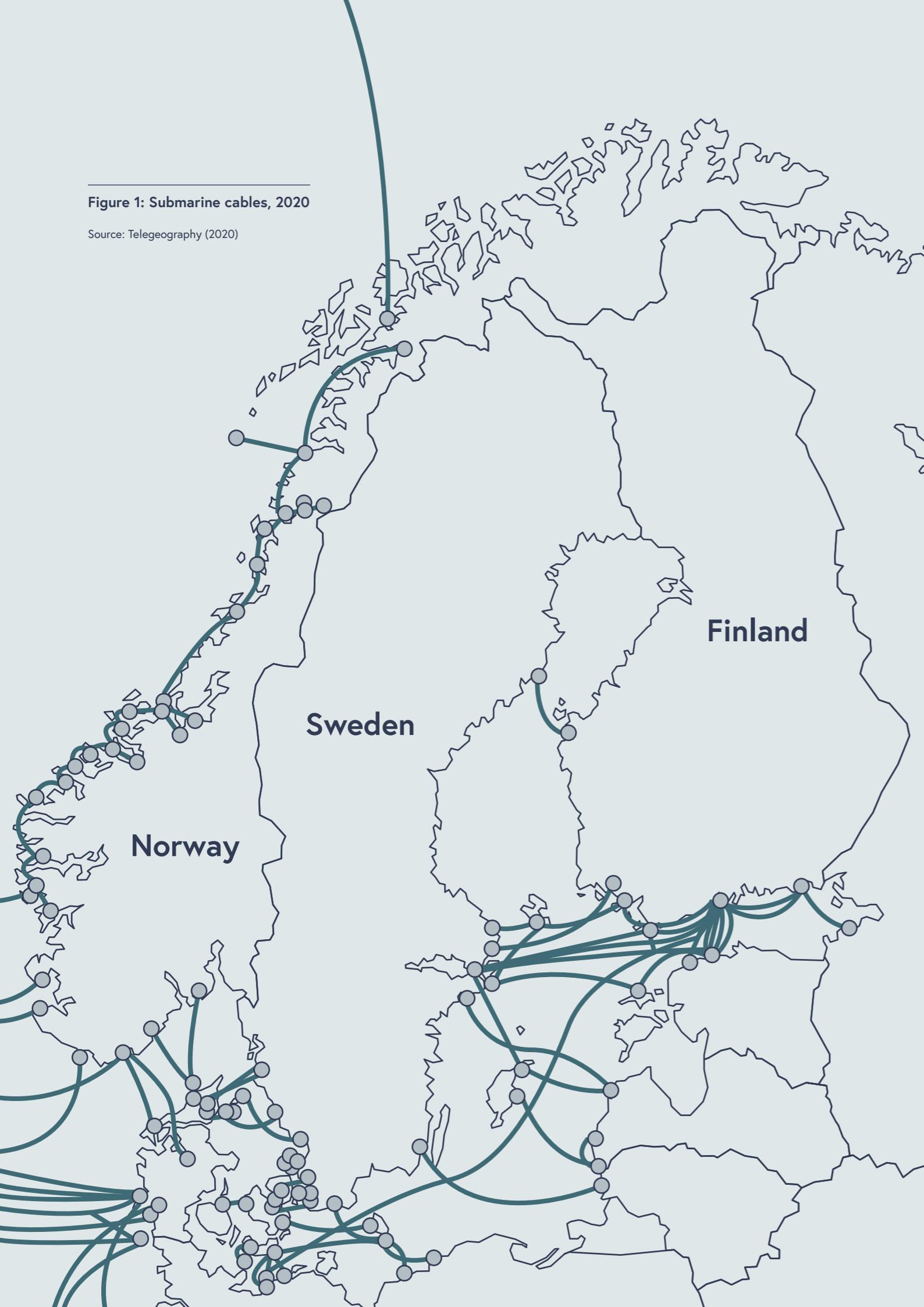
portant facilities become more integrated in digital networks, they can become exposed to new cyber threats. This section discusses some of the challenges Finland, Norway and Sweden share as they spearhead the global trend of digitalisation.

²⁵ Finland, Norway and Sweden top the rankings in the Digital Economy and Society Index. European Commission (2019b): Digital Economy and Society Index; European Commission (2019c): Country report. Norway.

²⁶ OECD (2019b): Global forum on digital security for prosperity; OECD (2019c): Critical information infrastructures protection (CIIP).

Figure 1: Submarine cables, 2020

Source: Telegeography (2020)



Digital services, which widely encompass elements such as operating systems, corporate and public data management systems, and cyber security services, constitute another, equally crucial element in the Finnish digital infrastructure. In terms of market share, the major providers of IT software and services in Finland are Tieto and CGI, followed by a number of smaller actors. The two companies operate across the Nordic countries: CGI has a strong presence in Sweden, and Tieto is merging with Evry, a Norwegian IT service-provider, thus creating a major Nordic IT house that controls significant market shares across all three countries.²⁷

The digital infrastructure operated by these and other agents is characteristically cross-border. Cloud services penetrating more and more organisational structures often run on a globally or Europe-wide scattered infrastructure; data centres that the internal systems the Finnish subsidiaries of multi-national companies use can be located abroad; and staff units vital to running companies' digital services might be outsourced beyond Finland or Europe. Increasingly, key elements of the digital infrastructure are outside Finland, and no market indications exist that they might migrate to Finland in the foreseeable future.²⁸

The Finnish national risk assessment 2018 identifies a wide range of challenges faced by digitalised Finnish society, noting that the potential for disruptions in communications services and networks is on the increase. The reliance of digitalised Finnish society on a network of maritime cables has long been considered in contingency planning. The more unconventional scenarios include problems in satellite communications or radio frequencies caused by geomagnetic storms or malicious interference; challenges in global infrastructures and foreign content delivery networks; and cyber-attacks and cybercrime leading to a paralysis that spreads across critical digital services.²⁹ New technologies, such as 5G networks, are creating a need for new, more comprehensive risk assessments.³⁰

The National Cyber Security Centre, the Securi-

ty Committee, and the NESAs are among the public actors in Finland facilitating a better understanding of and means to mitigate risks in a digitalising society. Some measures are well established: for instance, much of the physical communications infrastructure located in Finland is recognised as a critical element in national preparedness efforts. Planning involves cooperation with telecommunications and major IT providers, whose clients include major companies and public organisations. Officials have also established separate communications networks for emergency use.³¹ However, keeping up with the rapidly evolving digital environment requires continued efforts: for instance, the 2019 Digital Strategy by the Security Committee announces the launch of a national cyber security development programme.³²

While Finland benefits considerably from its cross-border digital infrastructure, new measures are being taken to ensure that society can manage the risks involved.³³ Cyber-attacks, fraud attempts and contagious computer viruses both in Finland and abroad have highlighted the need for more elaborate cyber capabilities.³⁴ The building of new perimeters is taking place, although the degree to which ICT security efforts are implemented in the public and private sector varies.³⁵ The criteria for what constitutes a viable cyber defence are still relatively unharmonised, whilst at the same time cyber threats are growing more diverse and sophisticated. Knowledge of different solutions remains spread out among companies, organisations and individual experts, although several Finnish companies providing cyber security services have strong expertise in the field.³⁶

27 Tieto (2019): Tieto and EVRY are joining forces to create a leading Nordic digital services company.

28 e.g. Aaltola et al (2014): Towards the geopolitics of flows, 187.

29 Finnish Ministry of the Interior (2019): National risk assessment 2018, 16–18, 47–50.

30 European Commission (2019d): EU-wide coordinated risk assessment of 5G networks security.

31 Erillisverkot Group (2020): Erillisverkot Group.

32 Security Committee (2019): Finland's cyber security strategy 2019; Pelkonen, Antti et al (2016): Kyberosaaminen Suomessa – nykytila ja tiekartta tulevaisuuteen.

33 For a working definition of cyber security, see: Security Committee (2019), 4.

34 Yle (2019): Cyber attack in Lahti disrupts city services. 12 June 2019.

35 Finnish Chamber of Commerce (2019): Yrityksiin kohdistuvat kyberuhat 2019; Ali-Yrkkö et al (2019): Digibarometri 2019.

36 Interview at a cyber security company, Finland, 12 August.

NORWAY

This sector is characterised by long and complex supply chains, comprising of service operators and suppliers ranging from the small and local to the large and international. Gaining a coherent overview of the entire sector is therefore rather difficult, not least also because it is a sector constantly changing with the advent of new technologies. Nevertheless, a general understanding can be achieved by looking at the electronic communications infrastructure and services.

The infrastructure and production of services is entirely commercially based. There are three core national telecommunications networks in Norway, owned by Telenor, Global Connect (previously Broadnet) and Altibox. Telenor's largest shareholder is the Norwegian state. Global Connect and Altibox's core networks rely to some degree on its infrastructure, and the company has the most developed network with a 51 per cent market share in 2017. A series of other networks exist along transportation and energy axes, usually developed to maintain preparedness and robustness in those organisations.³⁷ In addition to this, smaller commercial enterprises own and maintain regional and local networks, and rent core network access from the core providers.³⁸ Foreign telecommunications providers operate in the Norwegian market, such as Telia, the Swedish mainstay, which in 2017 had a market share of 19 per cent, though all on rented core networks.³⁹

While cables and physical infrastructure stretch across borders, there is very little cross-border feed of telecommunications services provided. Major firms, such as Telenor, for example, do operate in many countries. But nonetheless they are, as a rule, discrete entities operating on discrete infrastructures, operated under the parent company. This is mainly due to commercial propriety and security concerns.⁴⁰

Cloud-computing services are making a significant headway in the market, mainly in the private sector. Public sector institutions are following this adoption, spurred on by an expectation from the gov-

ernment that they should consider cloud-services on the same grounds as traditional, networked services. One problem with this is that it introduces the problem of virtualising infrastructures more acutely. Some raise concerns in this regard in terms of privacy or national security.⁴¹ The rationale is that virtualized infrastructures will create more diffuse value chains outside of national borders. Digital value chains today often comprise a large number of providers; mobile payment systems for example, incorporate somewhere around 20–30 different companies in their value chains, which means that it may be difficult to ensure adequate oversight.⁴²

Communications and digital networks have fundamental interdependencies with other sectors: they are dependent on the supply of electricity and energy while functioning as a bedrock for increasingly digitalised systems across society. At the governmental level, the infrastructure of telecommunications and cyber networks is the responsibility of the Ministry of Local Government and Modernisation (KMD).⁴³ Operating under the Ministry is the Norwegian Communications Authority (Nkom), which, among other tasks, supervises telecommunications providers. Where Nkom monitors with broad oversight, commercial enterprises control the networks.⁴⁴ Other agencies, such as the Norwegian National Security Authority (NSM) also work in the sector with regards to the security aspect, especially through its administration of the National Cyber Security Centre (NCSC) and the Norwegian Computer Emergency Response Team (NorCERT) operating under it.

Regarding preparedness measures, there is very little incentive for the Norwegian providers of communications infrastructure to act outside of a commercial interest. The supply of and through such infrastructures is controlled by commercial concerns and corporate deal making: when capacities are reached or surpassed, the decision to expand the service and thereby the supply comes down to a commercial cost-benefit analysis.⁴⁵ However, some

41 Norwegian Ministry of Local Government and Modernisation (2015–2016): Meld. St. 27: Digital agenda for Norge – IKT for en enklere hverdag og økt produktivitet.

42 Lysne, Olav (2019): Olav Lysne på Sikkerhetsfestivalen 2019.

43 The responsibility was recently transferred to this ministry from the Ministry of Transport (formerly, -and Communication).

44 Interview with NSM.

45 Interview with NSM.

37 Norwegian Communications Authority (2017): Robuste og sikre nasjonale transportnett – målbilder og sårbarhetsreducerende tiltak.

38 Interview with NSM, Norway, 18 September.

39 Norwegian Communications Authority (2017).

40 Interview with NSM.

More and more societally critical infrastructures are dependent on the functioning of the telecommunications infrastructure, increasing protectionist thinking.

arrangements are in place. For instance, the Electronic Communications Network and Electronic Communications Service Regulation of 2004 provides the regulatory structures with which the sector is governed, and includes the option for the government to take control of the networks in the event of a severe crisis.⁴⁶

Another large component of preparedness efforts is the electronic communications infrastructure built and run for the express purpose of preparedness: Nødnett. While some countries rely on communications networks mainly centred around emergency services, Nødnett covers the broad spectrum of crisis response. Fire, health and police services naturally have access to the network, but so do a range of other relevant actors, such as government ministries, county authorities, energy providers, and NGOs for example. This helps the relevant actors communicate securely during crises, avoiding networks more vulnerable to downtime or overload.

Counterintuitively to the larger trend of globalization, telecommunications providers and supply chains are remaining domestic. This is in part due to the emergence of security concerns surrounding these critical infrastructures, but also due to profitability and propriety considerations.⁴⁷ More and more societally critical infrastructures are dependent on the functioning of the telecommunications infrastructure, increasing protectionist thinking.⁴⁸ One example of national reactions is the debate on the supply of 5G technologies offered by the Chinese firm Huawei. Several nations, including Nor-

46 Norway (2004): Forskrift om elektronisk kommunikasjonsnett og elektronisk kommunikasjonstjeneste (ekomforskriften).

47 Interview with NSM.

48 Norwegian Ministry of Local Government and Modernisation (2015–2016).

way, have voiced concerns over offering contracts of such critical importance to distant interests.⁴⁹ Another example is the push to build redundancies: the primacy of Telenor's core network is seen more and more frequently as a vulnerability, and alternative core networks, such as Nødnett, are desired to spread the risk.⁵⁰

The development of new technologies, such as cloud services and fibre transmission, increasingly provides opportunities to abandon a tiered infrastructure, such as local networks branching out from regional networks, which in turn branch out of core networks. Transmission nodes acting like transfers between infrastructure levels are being replaced by cloud or fibre 'thoroughfares', eliminating the need for steps in the system.⁵¹ This could also open up the possibility of telecommunications capacities being housed in server farms outside of national borders, disrupting the current supply systems. What challenges and opportunities this poses for the sector remains to be seen.

SWEDEN

The sector encompasses several hundred suppliers, from local to multinational service and infrastructure operators, and the rate of technological change affecting them is rapid. Accordingly, there are multiple ways to group the actors, technologies and infrastructure within communications and digital

49 Sabbagh, Dan (2019): China 'must clean up its cyber act' for Huawei to be used in 5G network.

50 Norwegian Communications Authority (2017): Robuste og sikre nasjonale transportnett – målbilder og sårbarhetsreducerende tiltak.

51 Interview with NSM.

networks.⁵² This section will mainly focus on electronic communication networks and communication services.

The most significant providers of the infrastructure necessary for electronic communications are the partly state-owned Telia Company AB and Telia Wholesale; Telenor AB Sverige, which is controlled by the Norwegian state; Tele2 Sverige AB and Hi3G Access, which are controlled by Hong Kong-based CK Hutchison; IP-Only, the state-owned Teracom, Netnod,⁵³ Stokab (Stockholm); and Gothnet AB (Gothenburg). Other relevant providers of communication services are Triangelbolaget and Easy, which utilise the networks operated by Svenska Kraftnät, Ellevio, Vattenfall Distribution and E.ON. The entities listed above provide networks including wire and wireless transmission, nodes, access networks and access points. The major providers of mobile communication services are Telia, Tele2, Tre (Hi3G Access), Net1 and Telenor. Additionally, two authorities – the Swedish Transport Administration and Svenska Kraftnät – own and operate significant national networks.

Such communications infrastructure is critically dependent on energy supply, primarily electricity. Other dependencies include resources such as personnel, as well as deliveries of hard- and software, spare parts and fuel. Some sectoral risks mentioned during interviews and in risk and vulnerability analyses are natural hazards such as windstorms and thunderstorms, and fires in supply tunnels, which can affect equipment and cause disturbances lasting up to approximately one week. A long-lasting power outage or a longer disruption in the supply of energy, hardware or personnel could equally cause more serious disturbances. Other, less geographically confined challenges include cyber-attacks and prolonged barriers to global trade, since Sweden is dependent on the import of hardware and spare parts produced abroad, mainly in China.⁵⁴

The Swedish Post and Telecom Authority (PTS) monitors the public electronic communications

sector in the country.⁵⁵ PTS is a regulator with special tasks for emergency preparedness and response measures, and has an overall sectoral responsibility for the security of the supply of services.⁵⁶ It has identified certain operations as vital national functions in order to support the development of appropriate requirements and prioritisation schemes.⁵⁷ The PTS regulation includes plans and arrangements for reliable operation on predefined service-levels.⁵⁸ It also has bilateral cooperation and arrangements with several of the operators and authorities. For instance, the agency has begun developing a more holistic approach to managing spare parts, since there is no authority with explicit overall responsibility on this issue. Besides PTS regulation, the EU and national legislations require providers of electronic communications to maintain operations in their services during disturbances.

Importantly, PTS manages the national coordination group Nationella Televerksamsgruppen (NTSG), which includes authorities and public and private companies possessing equipment, knowledge or other resources essential for Sweden's critical telecommunication infrastructure. The group conducts exercises and training events, facilitates exchange of information on preparedness measures, and maintains situational awareness during disturbances. For this purpose, PTS provides a common web platform, and maintains sub-groups on specific issues, such as the infrastructure group for local broadband network owners. Generally, the operators are positive about cooperating with authorities in preparedness planning. Due to the competitive market, they usually request compensation for specific preparedness measures, in particular those required for a heightened state of alert.⁵⁹ PTS collects a preparedness charge from the operators and manages a special-purpose fund for preparedness measures.

55 Sweden (2003): Lag (2003:389) om elektronisk kommunikation.

56 Sweden (2015b): Förordning (2015: 1052) om krisberedskap och bevakningsansvariga myndigheters åtgärder vid höjd beredskap.

57 The operations include network security monitoring, of services and active components; assets and connections of national and international importance; certain incident management and corrective maintenance elements; and communication between vital societal functions in all sectors.

PTS (2016): 2016-års risk- och sårbarhetsanalys för PTS och dess ansvarsområden.

58 PTS (2015): Post- och telestyrelsens föreskrifter om krav på driftsäkerhet.

59 PTS (2020): Total defence.

Furthermore, the Swedish Forums for Crisis Preparedness on Technical Infrastructure (SOTI) is another forum for coordinating disaster preparedness and civil defence activities initiated by the central governmental actors in Sweden. Its aim is to strengthen responsible actors' ability to prevent and manage events that cause disruption to supply of energy, electronic communications, water, information and media.

A fresh development in total defence is taking place in Sweden. For instance, PTS is conducting training and exercises on civil defence with relevant sectoral actors, which in turn affects the scenarios they include in their preparedness planning. Interviewees at the agency also anticipated that public actors would need to develop their procurement procedures, and that they could place more reliability requirements on private operators to maintain their systems and supply chains during disturbances. They also brought up a need to develop a new and sustainable system for financing the higher requirements for civil defence currently unfolding in Sweden.⁶⁰

Cooperation

Finland, Norway and Sweden routinely participate in established transnational regulation, such as on radio-frequency spectrum and standardisation through the International Telecommunication Union (ITU). Some pivotal platforms include the OECD, which facilitates member state cooperation in data governance, privacy and digital security, and NATO, with which the three countries engage in differing ways, and which, for instance, has addressed questions on cyber defence cooperation.⁶¹ As the digital field is rapidly developing, the themes are not strictly confined to specific platforms, and discussions and measures overlap with each other.

For EU Member States Finland and Sweden, as well as for Norway, the EU is an important platform for addressing issues linked with digitalisation. One of the rising themes is cyber security, and the Cybersecurity Strategy of the EU, launched in 2013, followed by the directive on network and information security (NIS) in 2016 and the EU Cybersecurity Act adopt-

60 Interview at the Swedish Post and Telecom Authority.

61 OECD (2019d): Digital security and resilience in critical infrastructure and essential services.

ed in 2019, lays out the swiftly developing basis for a union-wide approach. The regulation requires each Member State to establish their own NIS authorities and response teams, creates a cooperation group for Member States to enhance strategic cooperation and the exchange of information, gives a permanent mandate for the EU Cybersecurity Agency, and sets in movement a framework for European Cybersecurity Certificates in order to harmonise standards for countering cyber threats throughout out Union.⁶² The EU is also important to Norway: the country has adopted the NIS Directive and takes part in the Digital Single Market, a European Commission initiative to support e-commerce, improve telecommunications infrastructure, and ensure the digital development of Europe as a whole. Norway adheres to the EU requirements for competition in telecommunications by allowing enterprises with large market shares to rent existing infrastructures; Telenor, for instance, has been subject to this requirement for several years.⁶³

To facilitate cooperation amid increasing digital solutions, the five Nordic countries have a general agreement on the mutual protection and exchange of classified information.⁶⁴ Recently, strides have been taken in some bilateral and trilateral schemes. A prominent example is the integration of the Norwegian Nødnett, the Finnish Virve and the Swedish Rakel, public safety communication networks. Norway and Sweden have partnered with Motorola and Airbus Defence and Space to manage the ISI project, which aims to ensure seamless command and collaboration in communication between Nødnett and Rakel. There are also good examples of cooperation with the Baltic countries in maintaining communication networks: Sweden has received assistance from Estonia, Lithuania and other countries to repair infrastructure following storms and other incidents.

Countering cyber threats has also been a theme for Nordic cooperation. The momentum for such collaboration was already growing at the time of the Stoltenberg report in 2009, and the Nordic Council has recently reiterated the need for closer coopera-

62 European Commission (2019e): Cybersecurity.

63 Norwegian Ministry of Local Government and Modernisation (2015–2016).

64 Denmark, Finland, Iceland, Norway and Sweden (2013):

General security agreement of the mutual protection and exchange of classified information between Denmark, Finland, Iceland, Norway and Sweden.

...preparedness in digital services and solutions constitutes a multi-faceted and prominent area for trilateral cooperation.

tion between the Nordic countries on cyber defence, as well as the need to include the Baltic countries in such efforts.⁶⁵ For instance, the authorities have established GovCERT, a graded communication network for alerting, analysing and preparing responses to digital attacks, and cooperation between the Nordic Computer Emergency Response Teams has been developed to reap force multiplier benefits from the exchange of information and best practices. The NORDEFECO, a Nordic military cooperation forum, has served as a forum for both high-level and low-level arrangements.⁶⁶ Additionally, new bilateral initiatives emerge, such as Finland and Sweden making initial attempts to explore their cyber capabilities together.

To perform an initial assessment, preparedness in digital services and solutions constitutes a multi-faceted and prominent area for trilateral cooperation. Finland, Norway and Sweden are currently building national measures to accommodate, and to an extent find alternatives to, critical digital infrastructures and services that rely on functional cross-border connections. They also make use of their institutional memberships, most importantly in the EU and NATO, to pool resources, share best practices and set common standards. While bilateral and specific Nordic arrangements exist, regional collaboration complementing the national and wider multi-lateral efforts has not reached its full potential, even though calls for more determined measures have been voiced for some time.⁶⁷

The pretext for further cooperation is there. Finland, Norway and Sweden are adopting digital operations and services, such as cloud computing services, at roughly the same pace, and share the ambition

of staying on top of the global and European trend in digitalisation (figure 2). They also rely on digital infrastructure operated from abroad, and many IT houses providing digital services to societally important companies and organisations are international entities. In the future, artificial intelligence, quantum computing robotics, the Internet of Things, smart automation of traffic, mass data, and positioning and temporal systems for traffic are just some of the many fields in which innovations may disrupt societally critical infrastructures in the three countries.⁶⁸ Cooperation to strengthen preparedness measures in specific sectors, such as energy or transport, may falter if the national solutions in digital security to accommodate such technology are incompatible.

Some preconditions are yet to be filled. Engaging in deeper cooperation requires compatible policy approaches to digital security. The three countries could find synergies in identifying the best solutions, as long as the collaboration schemes can be harmonised with measures taken at national level.⁶⁹ This report highlights that the national approaches to cross-border dependencies can become more aligned. To illustrate, each country wrestles with concerns related to foreign elements in the digital infrastructures and services. To some practitioners, an organisation that takes up cloud-based solutions makes its IT systems less exposed to disruptions by disseminating its data centres abroad. To others, extraterritorial critical infrastructure exposes the organisation to further disruptions.⁷⁰ More than in any other sector, the field of preparedness in digital operations and services is immature, with the threats and solutions to them in flux, and few institutionalised solutions available.⁷¹

65 Haugevik, Kristin et al (2019): Ten years on: Reassessing the Stoltenberg report on Nordic cooperation; Nordic Council and Nordic Council of Ministers (2018): Nordic Council: Cyber threats should be tackled by way of closer co-operation.

66 Haugevik, Kristin et al (2019).

67 Interview at the NESAs, Finland, 14 May.

68 Finnish Ministry of the Interior (2019), 17–18.

69 Interview at the Swedish Post and Telecom Authority, Sweden, 29 August.

70 Cf. state-based and nomadic flow models of territoriality. Aaltola et al (2014), 177.

71 Interview at a cyber security company, Finland, 12 August.

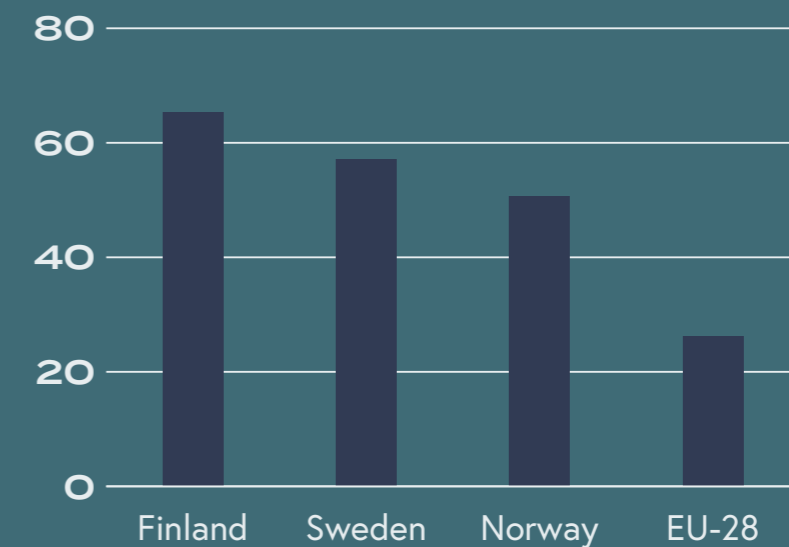


Figure 2: Use of cloud computing services by enterprises, % of enterprises, 2018.

Source: Eurostat 2018a

Discussion

This section discusses some suggestions for further cooperation compiled during the research. One way for Finland, Norway and Sweden to facilitate fruitful collaboration is **to develop more aligned agreements regarding partnerships in digital services and solutions**.⁷² These could include the national authorities coordinating their interactions with a set of key companies that serve as key providers throughout the region.⁷³ Major IT companies operate in most Nordic countries, in which they are subject to multiple, sometimes diverging, regulatory environments. Surely, the authorities must retain control of who can operate nationally vital digital services. However, further coordination regarding the way the national authorities make deals with cross-nationally operating IT houses can benefit the sharing of best practices as a whole. A linked cooperation scheme could involve developing similar terms and conditions for the operators in the Nordic countries with regard to implementing EU regulations.⁷⁴

Another area for collaboration could be **to strengthen existing cooperation platforms for cyber security or to build new ones if needed**. For instance, the countries could reap scale benefits by pooling together resources for risk analysis on physical infrastructure and research on machine learning. Undoubtedly, it is unclear whether new cross-border units could be of use in areas in which institutions for collaboration already exist. Strengthening current platforms for collaboration, such as the Nordic Financial CERT in the banking sector (see chapter 4), mixed with support for new elements, such as the forthcoming EU cyber cybersecurity competence centre, can help enhance the region's readiness to resolve cybersecurity challenges.⁷⁵ Generally, as many challenges in cyber security are faced by each country, key insights to solving them could be gleaned by pooling instead of sequestering the information.

A third potential area for collaboration is **to tackle the shortage of national expertise needed to manage the digital infrastructure and to counter cyber threats**. For instance, the Finnish Security Committee highlights that although the level of digital know-how in Finland is high, specific operations and services often hinge on the expertise located or acquired abroad.⁷⁶ An interviewee in Sweden voiced a similar concern regarding lack of expertise during major incidents, cyber-related or otherwise.⁷⁷ As small economies, the Nordic countries have trouble maintaining sufficient competence and personnel within the country to manage their spearheading digital systems and solutions. Instead of trying to nurture national capacities in all areas, the authorities in Finland, Norway and Sweden, or in the Nordic countries as a whole, could cultivate shared expertise, for instance by jointly financing and organising training and staff exchange programmes in cooperation with universities and companies.

As small economies, the Nordic countries have trouble maintaining sufficient competence and personnel within the country to manage their spearheading digital systems and solutions.

⁷² Interview at the Swedish Post and Telecom Authority; interview at a cyber security company, Finland, 21 August.

⁷³ *ibid.*

⁷⁴ *ibid.*

⁷⁵ Nordea (2017): Nordic banks collaborate on fighting cybercrime; European Commission (2019f): Proposal for a European cybersecurity competence network and centre.

⁷⁶ Security Committee (2019), 8.

⁷⁷ Interview at the Swedish Post and Telecom Authority.

3

Energy

Countries

FINLAND

The primary state-level public institutions overseeing the energy sector in Finland are the Ministry of Economic Affairs and Employment and the Finnish Energy Authority. Finnish society consumes electricity produced using a range of energy sources, the most important of which are wood fuels, oil and nuclear energy. The country remains a net importer of electricity: around 23 per cent of the electricity supply is provided by net imports, and during cold winter days the reliance grows significantly. Most imported electricity comes from Sweden with further purchases from Russia and Estonia.⁷⁸ The Nordic market Nord Pool is a key component in Finland's

78 In 2018, energy sources for total consumption were as follows: wood fuels (27%), oil (22%), nuclear energy (17%), coal (8%), natural gas (5%), net imports of electricity (5%), others (5%), peat (5%), hydro power (3%), and wind power (2%). Statistics Finland (2019): Energy in Finland.

strategy to ensure access to electricity.⁷⁹

Finland also imports energy carriers, especially fossil fuels. Natural gas, which in 2018 accounted for five per cent of Finland's total energy consumption, is supplied via two gas pipes from Russia. Crude oil is imported by oil tankers from Primorsk, a major Russian port, and refined mostly in oil refineries operated by Neste, a state-owned Finnish energy company. While Russia remains a major provider, other import channels have emerged: St1, an energy company, has begun purchasing much of its crude oil from Norwegian producers for its refinery in Gothenburg, Sweden, which in turn ships refined fuel products to Finland. Furthermore, the increasing number of LNG terminals in Finland, as well as the Balticconnector, a natural gas pipe between Finland and Estonia set to be fully operational in 2020, are diversifying Finland's sources of fossil fuels.⁸⁰

79 NESÄ (2015): Energiapula – pohjoismaisen sähköverkon mahdollisen häiriön hallinta.

80 Interview at the NESÄ, Finland, 22 October; interview at an energy company, Finland, 17 September; interview at an energy company, Finland, 10 September; IEA (2018): Energy policies of IEA countries. Finland – Executive summary.

OVERVIEW

This section discusses the production, transmission, distribution and use of electricity and energy carriers, which are vital to contemporary Nordic societies. A special characteristic of the Nordic region is its deeply integrated electricity market, which reflects a longer trend towards collaboration made possible by the countries' complementary energy mixes (figure 3). Cooperation between the national grid operators, or Transmission System Operators (TSOs), started already in the 1960s. In the

1990s, hydropower imported from Norway and Sweden was seen as useful in Denmark for replacing expensive domestic production during peak consumption. Mutual trust between the stakeholders involved has been a key element facilitating a system of closely interdependent national electricity networks.⁸¹ Additionally, the EU has supported regionalisation as a step towards European internal energy markets.⁸²

Another regional characteristic is the cross-border nature of the major energy companies. To illustrate, the Finnish Fortum and the

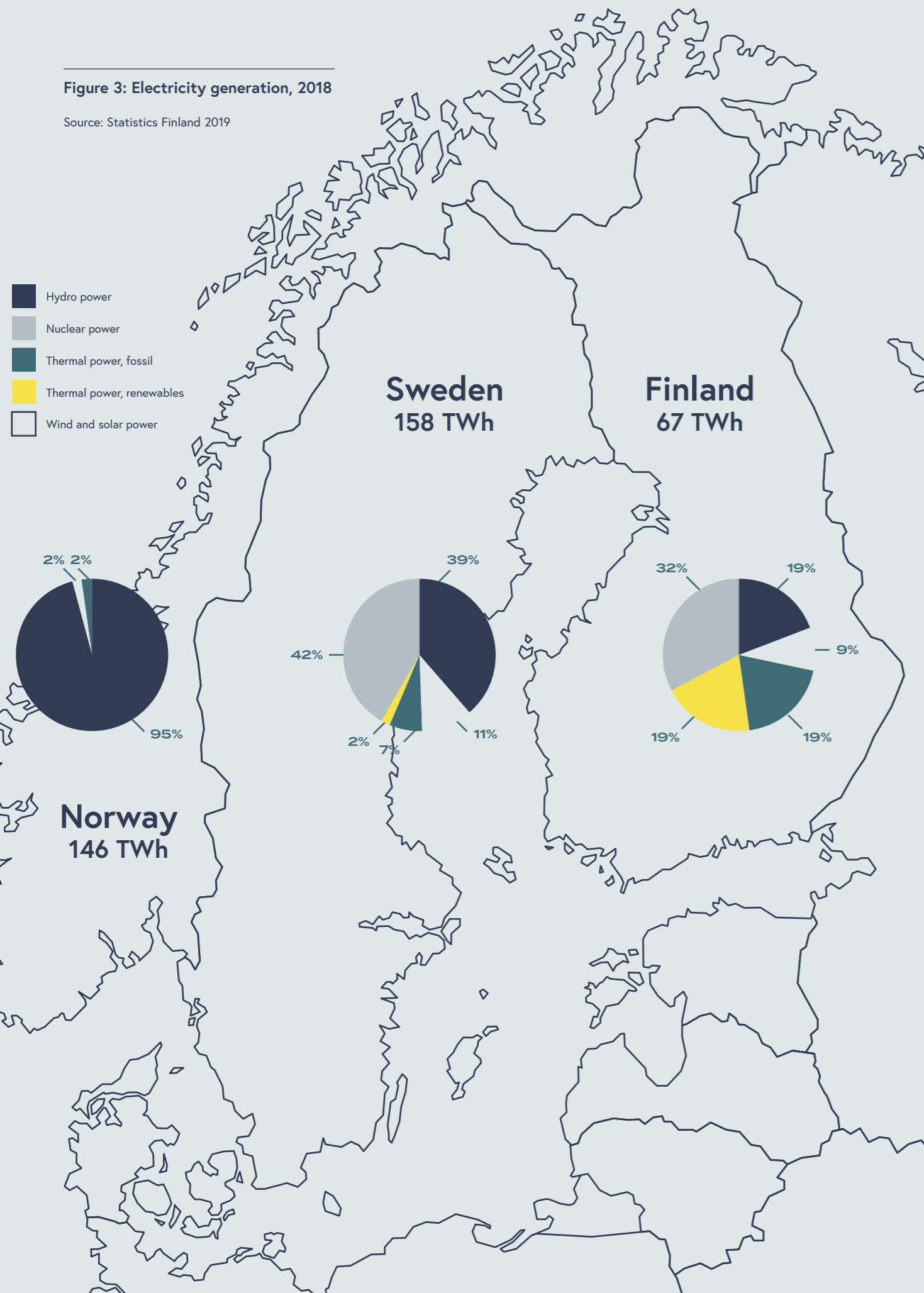
Norwegian Statkraft, both state-owned power generators, operate across the Nordic countries; St1 controls over 1300 St1 and Shell branded retail filling stations in Finland, Sweden and Norway; the Finnish state-owned company Gasum is a leading regional distributor of LNG and supplier of biogas; and maintenance service providers for the electricity grid, such as Eltel, Empower and Maintpartner, operate across borders. The connections between the three countries' energy sectors are deep, involving multiple arrangements to mitigate disruptions in them.

81 Ollila, Jorma (2017): Nordic energy co-operation: Strong today – stronger tomorrow, 29.

82 Eurostat (2019a): Shedding light on energy in the EU.

Figure 3: Electricity generation, 2018

Source: Statistics Finland 2019



Finland is undergoing a shift towards renewable and smart energy systems. The use of fossil fuels decreased in the generation of electricity and district heat by 12 per cent in 2017, and the proportion renewable energy accounts for of total energy consumption has risen between 2010 and 2018 by 10 percentage points, from 27 to 37 per cent.⁸³ Finland aims to stop the use of coal as a source of electricity and heating by 2029.⁸⁴ The transition will also affect imports, for instance as biomass is increasingly used not only for power and heat generation but in second-generation biofuels, whereby raw materials will have to be potentially imported from elsewhere.⁸⁵ Investments in biofuel facilities are part of a wider shift away from fossil fuels, which includes making use of renewable energy sources, the ongoing construction of Finland's fifth nuclear power plant, and the planning of its sixth such facility.⁸⁶

The primary national agencies fostering resilience are the Energy Authority, the regulator, and the NESAs, which provides a platform for information-sharing, guidance and peer-review tools for companies.⁸⁷ Energy production, transmission and distribution networks are considered as critical infrastructure services in Finland, and accordingly treated as high priority.⁸⁸ Even short-term outages can have severe cross-sectoral effects in Finnish society, as the digitalised economy depends on electricity.

Extensive and long-term disruptions in domestic electricity distribution have resulted exclusively from weather conditions.⁸⁹ While the last nationwide power outage occurred in the 1970s, fallen trees and compacted snow have caused extensive and long-term regional interruptions in power supply also recently. In 2010 and 2011, blackouts due to major storms created momentum for the reformed Electricity Market Act, as a result of which energy

companies are investing heavily in improving the reliability of the domestic distribution networks.⁹⁰ Furthermore, Fingrid, the national grid operator, owns and leases reserve power plants, which are used in emergencies, for instance when a fire at Fingrid's Olkiluoto substation led to two nuclear power plants being brought to a halt in July 2018.⁹¹

Additionally, changes in the international availability of electricity and energy carriers can have a severe impact. Generally, the supply of both has remained stable. The Nordic electricity market has provided a steady source of electricity, and from a Finnish perspective Russia remains a reliable supplier of oil and gas. Were the situation to change, Finland stockpiles coal, oil, nuclear fuel and domestic peat.⁹² For instance, the importers of oil and oil products have a statutory stockpiling obligation corresponding to the volumes they import.⁹³ Reserves located both in Finland and abroad equate to several months' consumption of oil. Finland participates in international coordination to mitigate any supply risks, for instance through the International Energy Agency and the OECD. As a step towards an integrated internal energy market, the EU has been a major financial supporter of the Balticconnector pipe, which will provide Finland with a new source of natural gas.

The energy transition will pose a multi-faceted challenge to the country's security of supply efforts. Fossil fuels have formed the basis for Finnish stockpiles as sources of electricity and heating. If the facilities for burning fossil fuels are gradually phased out, they have to be replaced with new arrangements. New energy sources, in turn, will create new dependencies: for instance, the domestic production of biomass is unlikely to cover the estimated demand if new biofuel technologies are to serve international markets.⁹⁴ Finally, the Nordic countries executing their own energy transitions might hinder Finland's national preparedness efforts, if they lead to a situation in which imported electricity for peak consumption becomes less available.

83 Statistics Finland (2018): Use of renewable energy sources grew in electricity and heat production in 2017; Statistics Finland (2019).
 84 Finnish Ministry of Economic Affairs and Employment (2019): The act banning the use of coal for energy generation in 2029 to enter into force in early April.
 85 IEA (2018); Pöyry (2019): Huoltovarmuus energiamurroksessa – raportti Huoltovarmuuskeskukselle.
 86 IEA (2018), 3–4.
 87 OECD (2019e): 'Critical infrastructure resilience case-study: Electricity transmission and distribution in Finland' in OECD (2019): OECD reviews of risk management policies.
 88 Finland (2018): Stårådetts beslut om målen med försörjningsberedskapen
 89 Finnish Ministry of the Interior (2019), 42.

90 OECD (2019e).
 91 Fingrid (2018a): Reserve power plants; Fingrid (2018b): Risk of electricity shortage in Finland on Thursday.
 92 IEA (2018), 3–4.
 93 Finland's oil stocks equal 240 days of 2017 net-imports, whereas the IEA expects the minimum of 90 days from its members. IEA (2018), 3–4.
 94 Luke (2018): Wood imports increased clearly in 2018.

NORWAY

The governmental responsibility for the production of electricity as well as the production and refining of crude oil rests with the Ministry of Petroleum and Energy (OED), while the responsibility for the supply of fuels to private and public consumers rests with the Ministry of Trade, Industry and Fisheries (NFD). The OED is also in charge of Norwegian energy policy as a whole. In terms of hydroelectric power, the Norwegian Water Resources and Energy Directorate (NVE) operating under the OED is responsible for managing the water and energy resources.⁹⁵

At operational level, the government fully owns two state enterprises. Statnett, owned by the OED, operates the Norwegian transmission grid, while Statkraft, owned by NFD, is a producer of hydroelectric power and operates internationally. Some production facilities and parts of the power grid are privately owned, but a large majority of these infrastructures belong to state and regional authorities, or to the aforementioned state-owned enterprises.⁹⁶

Norway is self-sufficient in its electrical power supply, thanks mainly to its comprehensive, hydroelectric power-production system.⁹⁷ In total, hydroelectric power production is the sources of over 91 per cent of the country's electricity, including imported electricity.⁹⁸ Because hydroelectric power relies fundamentally on precipitation (as opposed to thermal fuels in most of the rest of Europe), energy can be stored for future use in storage reservoirs. Flexible hydroelectric plants can thereby produce electricity even in periods of low precipitation.⁹⁹ In hydroelectric plants, electricity generated by turbines is transferred through a three-layered network consisting of the transmission network (previously the central network) the regional network, and the distribution network.¹⁰⁰

While Norway is in practice self-sufficient in elec-

tricity production, commercial aspects as well as balancing needs create an incentive for Norwegian energy firms to enter the international market. The numbers are illustrative on this point: of all sources of electricity, 4.88 per cent comes from imports; meanwhile, of all end uses of electricity, exports accounted for 15.26 per cent.¹⁰¹ Trading can occur bilaterally between individual power providers and power producers, but most often takes place at the multinational power exchange Nord Pool.¹⁰²

Norway produces crude oil and gas, and virtually all of the oil and gas produced in Norway is exported. This means Norway is not only a net energy exporter, but a significant exporter of oil and gas globally. For example, Norway supplies about 25 per cent of the gas demand in Europe. Since the year 2000 (with the exception of a small dip in 2016), the export of oil and gas combined has comprised over half of all Norwegian exports, making the resource vital to the Norwegian economy.¹⁰³

The supply of fuel produced using crude oil and gas is subject to pricing and trading in an international market. Fuel supply is maintained largely by the five major members of Drivkraft Norge, the industry association for fuel and energy companies in Norway: Circle K, Esso, Preem, St1 and Uno-X. These account for 97 per cent of the supply, including two refineries, a series of large processing sites and terminals, and a network of smaller sites connected to the distribution network. Instead of each firm building its own sites and distribution systems, the firms work together extensively in intake and distribution, renting services, tank systems and site operations. In a departure from the past, the sector is now largely fractionalized into distributors and producers. For instance, Circle K used to be a distributor operating on behalf of Statoil, whereas it now sources fuel from various producers. Esso remains the exception by keeping the refining, distribution and sales from start to finish within its operations.¹⁰⁴

A critical factor in terms of ensuring electricity supply is to maintain an equilibrium in supply and use, called the instantaneous balance in the electricity system.¹⁰⁵ The network input and output needs

to be synchronized to avoid imbalances that could disrupt the system and cause the network to fail. In part, the system is controlled by adjusting electricity production, and in part by transactions between the domestic regions and international markets.¹⁰⁶ If the supply of electricity is threatened, the Energy Act of 1990 allows for the rationing of electricity in crises.¹⁰⁷ The same Act sets out which resources must be available for contingencies and a series of security and protection measures, and establishes the Power Supply Preparedness Organisation charged with restoring power supplies should there be an emergency.¹⁰⁸ The entity is run by the NVE, and includes the TSO, private grid companies, major producers and regional representatives of the sector.

In Norway, the trend of transitioning to non-fossil energy sources does not particularly impact the hydropower aspect of the energy sector, considering hydroelectric production already is 'green'. Some projects are in place to take advantage of wind energy by using wind turbines, which will add to Norwegian energy exports. There are, for example, currently 16 wind energy plants under construction, which are expected to double the production level of wind energy in the country. Plans for 39 additional plants have been also been unveiled.¹⁰⁹

The connections for fuel supply into Norway are also considered to be fairly secure, taking into account the significant domestic production and refinery capabilities, and strong ties with refineries in, for example, Sweden, should domestic capacity be exceeded.¹¹⁰ NFD's Regulation on a Council for Fuel Preparedness and the Fuel Industry's Preparedness Duties of 2018, which is based in the Business and Industry Preparedness Act, sets out the legal framework for preparedness efforts in supply of fuel.¹¹¹ It establishes a permanent council on fuel preparedness populated by industry experts, and facilitates the storage of fuels for use in the event of a shortage or crisis. The NATO's seven baseline requirements for national resilience also place expectations on the Norwegian energy sector.¹¹² As a net exporter of ener-

gy, Norway is exempt from the International Energy Programme's requirement that emergency stocks be held for the equivalent of 90 days of oil imports (see below).¹¹³ Nevertheless, Norwegian law compels significant producers and importers of petroleum products to maintain emergency stocks for the equivalent of 20 days of production or import amounts.¹¹⁴

Also in the fuel sector, firms are seeking ways to diversify into 'greener' energy sources.¹¹⁵ Furthermore, the fuel industry is facing an increasing rate of specialization and outsourcing; where firms previously handled large parts of the supply chain in-house, they now focus on specific core operations, opting to rent, contract out or lease auxiliary services and functions. This results in more fragmented supply chains, and an increase in the number of firms operating different stages of the chains.¹¹⁶

SWEDEN

In recent years, crude oil coming into Sweden has come mainly from Russia and the North Sea, and most refined oil products have been imported from the Nordic countries. The supply of natural gas to the system of western Sweden, which distributes nearly all the gas used in the country, comes through one single pipeline connected to Denmark. For comparison, while natural gas is imported, biogas is produced locally, in proximity to the consumers, using mainly waste materials such as garbage, forest waste and manure.¹¹⁷

Sweden's electric grid can be divided into three levels: the national grid has connections to the Nordic countries and to Poland, Germany and Lithuania, while the regional grids are connected to national level, delivering electricity to local level. The electricity market is mainly Nordic or regional. Hydroelectric and nuclear plants are responsible for the vast majority of Sweden's domestic production of electricity, but cogeneration plants and wind turbines also play an important role.¹¹⁸ In 2016, an

95 Norwegian Ministry of Petroleum and Energy (2019a): Tildelingsbrev til Norges vassdrags- og energidirektorat for 2019.

96 Norwegian Ministry of Petroleum and Energy (2019b): Ownership in the Energy Sector.

97 Interview with Statnett, Norway, 19 November.

98 Norwegian Ministry of Petroleum and Energy (2020): Det norske energisystemet.

99 Norwegian Ministry of Petroleum and Energy (2019c): Security of Electricity Supply.

100 Interview with Statnett; Hagen et al (2017): Regulering av IKT-sikkerhet: Et helhetlig og fremtidsrettet sikkerhetsregime for forsyningsikkerhet i en digitalisert energisektor.

101 Norwegian Ministry of Petroleum and Energy (2020).

102 Hagen et al (2017).

103 Ministry of Petroleum and Energy & Norwegian Petroleum Directorate: (2019): Exports of oil and gas.

104 Interview with Drivkraft Norge, Norway, 4 November.

105 Norwegian Ministry of Petroleum and Energy (2019c).

106 Interview with Statnett.

107 Interview with Statnett.

108 Norwegian Ministry of Petroleum and Energy (2019c).

109 Statkraft (2020): Dette bør du vite om vindkraft i Norge.

110 Interview with St1, Norway, 5 November.

111 Norway (2018): Forskrift om et råd for drivstoffberedskap og drivstoffnæringens beredskapspliker. Translations authors' own.

112 NATO (2018): NATO's role in energy security.

113 IEA (2019): Oil security: The global oil market remains vulnerable to a wide range of risk factors.

114 Norway (2006): Forskrift om beredskapslagring av petroleumprodukt.

115 e.g. Equinor (2020): What we do.

116 Interview with Drivkraft Norge.

117 Swedish Energy Agency (2015): Risk- och sårbarhetsanalys över energiförsörjningen i Sverige år 2015, 9, 38, 44.

118 Swedish Energy Agency (2015), 8–9, 29.

agreement was made between five political parties in Sweden, stating as a goal that all electricity production is to be renewable by the year 2040. In 2018, the government reiterated this goal.¹¹⁹

Regarding the supply of heat and cooling, the markets are very limited geographically, comprising one or a few towns at a time. In the metropolitan areas, however, heating systems are being interconnected between municipalities, making the systems more flexible and robust.¹²⁰

Since the energy sector encompasses many different energy sources, it is exposed to a wide spectrum of risks. The threats include not only accidents and natural hazards but also deliberate actions, such as sabotage and terrorism. The threats also change over time due to changes in the energy systems themselves. Furthermore, the geographical scope of the market is different between energy sources: for example, the oil and fuel trade is part of a global market and thus exposed to geopolitical factors, while disturbances in the supply of electricity often occur at local level.¹²¹ While, as indicated above, the international connections of the sector vary between these different energy sources, generally, the companies in the sector, as well as their subcontractors, are international through both ownership and markets, which can lead to national agencies lacking jurisdiction over them.¹²²

The Swedish Energy Agency is an administrative agency whose responsibilities include promoting security of supply in Sweden's energy systems. The agency develops and coordinates the crisis management and preparedness planning of the sector, as well as monitors and analyses the sector and supports other agencies with its expertise. The agency also has certain responsibilities when it comes to rationing and other controls of energy use.¹²³ While the Swedish Energy Agency has an overarching responsibility for the security of supply of the energy sector, Affärsverket svenska kraftnät has certain responsibilities when it comes to security of supply of electricity specifically, acting as the TSO as well as

the Authority of Electricity Contingency Planning of Sweden.¹²⁴

The newly resumed total defence planning in Sweden addresses energy preparedness as one of its elements.¹²⁵ Swedish legislation requires public agencies to reduce societal vulnerabilities and to develop a capacity to perform their tasks even during crises and war. These efforts involve collaborating with and supporting other agencies during crises, conducting risk and vulnerability assessments, and participating in collaboration forums (Samverkansområden) with other agencies. The Swedish Energy Agency, (Energimyndigheten), Affärsverket svenska kraftnät and the National Electrical Safety Board all have such legal responsibilities.¹²⁶ However, there is no national actor with a responsibility for preparedness in the energy sector as a whole, and the obligations are divided between many different public actors.¹²⁷

Cooperation

Finland, Norway and Sweden are all members of the International Energy Agency (IEA), an autonomous body within the OECD framework, which was designed to help countries coordinate a collective response to disruptions in the supply of oil.¹²⁸ Connected to the IEA, the International Energy Programme (IEP) obliges member states to have stockpiles of oil corresponding to 90 days of net imports, to take measures to reduce the consumption of oil, and to participate in a system for the distribution of oil between the member states during a crisis. As stated above, Norway as an oil exporter is exempt from the stockpiling requirement. Another international platform of relevance is the EU, as its regulation, among other things, address the countries' oil stocks, natural gas and electricity markets and supply, and infrastructure investments.¹²⁹ For instance,

124 Sweden (2007): Förordning (2007:1119) med instruktion för Affärsverket svenska kraftnät; Sweden (1997): Elberedskapslag (1997:288).

125 Swedish Energy Agency (2019a): Återupptagen planering civilt försvar.

126 Sweden (2015b).

127 Interview at the Swedish Energy Agency.

128 IEA (2019): Our Mission; Wilson, Alex (2016): International Energy Agency: Origins and developments, 1.

129 Swedish Energy Agency (2013): Ansvar och roller för en trygg energiförsörjning – Energimyndighetens analys, 41, 44–45.

as a component of its climate strategy, the EU obliges member states to finalise their National Energy & Climate Plans (NECPs) by the end of 2020.¹³⁰ European cooperation on power grids takes place through ENTSO-E, an organisation populated by the European TSOs. Together with the Agency for the Cooperation of Energy Regulators (ACER), ENTSO-E maintains detailed guidelines and network codes enacted by the European Commission into European law. Norway, while not an EU Member State, strictly adheres to EU energy regulations.¹³¹

On a Nordic level, the most important arrangement is the Nord Pool common electricity market owned by the Nordic and the Baltic countries' TSOs.¹³² The deep integration of power grids between Denmark, Finland, Norway and Sweden facilitates and necessitates close coordination between the Nordic energy authorities, as one country's choices in grid investments, market solutions and operational security measures will affect the entire synchronous system. Hence, the national TSOs communicate regularly with each other. Furthermore, NordBER serves as a specialised forum on emergency preparedness for the Nordic energy and electricity authorities and the TSOs. The forum has two overarching goals: to promote ongoing exchange of information and experiences for preparedness planning regarding supply of electricity, and to perform such planning at Nordic level to complement national activities. Its activities include, for instance, Nordic risk and vulnerability assessments and joint exercises.¹³³

Though not entirely explicitly about security of supply of energy, there is also a cooperative research platform under the auspices of the Nordic Council of Ministers – the Nordic Energy Research. Nordic Energy Regulators (NordREG) is a linked organisation for the energy regulators of the Nordic countries to develop the Nordic and European electricity markets, and the Nordic Regional Security Coordinator, a joint office for the four Nordic TSOs, supports these operators in maintaining the operational security

130 European Commission (2019g): National energy and climate plans (NECPs).

131 Hagen et al (2017); Interview with Statnett.

132 Ollila (2017), 31–32.

133 Swedish Energy Agency (2013), 45–46; MSB (2015): Vägledning i att ta emot internationellt stöd, 61; Affärsverket svenska kraftnät (2014): Vägledning för krishantering inom elförsörjningen, 19.

of the power systems across the Nordic countries. Some Nordic cooperation also takes place on more specialised fuels, such as jet-fuels and fuels used in shipping. In general, though, this kind of bilateral or trilateral cooperation is scarce.¹³⁴

To provide an initial assessment, Nordic cooperation on energy security is partially very institutionalised, as the integrated electricity market has necessitated preparedness collaboration between the Nordic countries. The Nordic countries do not, however, cooperate equally in all relevant areas. Collaboration on fuel supplies takes place primarily through other fora, as the IEA and the EU set the basic requirements for oil storage and other measures, which are then complemented with national and bilateral arrangements. Instead of there being a dearth of collaborative arrangements, the multiple schemes overlap with each other. For instance, one interviewee lamented that NordBER, a platform specifically built to address preparedness issues in the Nordic energy sector, is somewhat underutilised, as the TSOs have their own communication channels and members participate in the activities with varying levels of enthusiasm.¹³⁵ According to another interviewee, there is a need to harmonise the diverse schemes in place and to develop them further, rather than to come up with new, redundant structures to deal with the same issues.¹³⁶ In a sense, the situation is welcome: there are overlapping platforms in place, which can be harnessed for trilateral or wider collaboration, if issues to be tackled through joint action emerge.

134 Interview with St1.

135 Interview at the NESAs, Finland, 13 June.

136 Interview at the Swedish Energy Agency.

Discussion

This section compiles some suggestions for trilateral cooperation, which emerged during the research process. Some are immediate and stem from past experiences, such as the suggestion **to share experiences on the kinds of contingency solutions and fuels used during power shortages**. However, this section places an emphasis a wider theme of policy shifts invoked by climate change. With differing energy mixes, especially regarding use of fossil fuels, each country is striking a careful balance between the various environmental, economic and security policy goals they might want to pursue. Nevertheless, one way to deepen the collaboration could be **to introduce the growing issue of climate change more systematically on the energy security agenda**.

As of yet, the implications of the countries' climate policies on energy security have not been subject to a structured discussion. Calls for such are, however growing: for instance, the IEA recommends that Finland '[f]oster the dialogue with the Nordic and Baltic neighbours on the design and implementation of climate and energy policies, in particular with regard to cross-border implications of electricity security and adequacy'.¹³⁷ Sweden also relies on a mix of fossil fuels, nuclear and renewable energy, as well as imports and exports electricity. Norway finds itself in a somewhat different position, as the country already produces almost all of its electricity through hydro power and sells its oil reserves to international buyers (figure 4). However, due to the integrated electricity market, the looming changes in the Nordic energy mix will affect each country's means to buy and sell electricity.¹³⁸

A potential joint measure for the three countries could be **to coordinate their national climate strategies so that their respective efforts in the energy transition cohere, or at least do not undermine, each other's energy security**. Establishing coherence between climate policies and security of supply policies is certainly chal-

lenging even on the national level.¹³⁹ However, the countries' energy policies have the potential to affect each other's national efforts to ensure access to energy. To widen the informational base needed for improved policy coherence, the countries could engage in joint undertakings **to map cross-dependencies between the energy sector and other sectors across Finland, Norway and Sweden**.¹⁴⁰ For instance, the countries could find it useful **to explore the collective capacity of the Nordic oil refineries to produce both fossil and special fuels vital to transport and other sectors, and to map the supply chains of the machinery and spare parts needed to produce and store energy in new ways**. Another linked theme, although far-reaching, is storage. Currently, most emergency reserves consist of fossil fuels. Developing new technologies to store and move energy, for instance in the forms of synthetic gases and hydrogen, is a global challenge. However, the three countries could find it useful **to support research and development schemes to store energy**, as the countries' security of supply planning would benefit from having more diverse storage means available in the future.

137 IEA (2018), 6.

138 NATO Energy Security Centre of Excellence (2019): Energy security: Operational highlights – beyond the era of fossil fuels.

139 Hakala et al (2019a): 'A lot of talk, but little action – the blind spots of Nordic environmental security policy' in Sustainability, 11(8); Hakala et al (2019b): 'Northern warning lights: Ambiguities of environmental security in Finland and Sweden' in Sustainability, 11(8).

140 OECD (2019e).

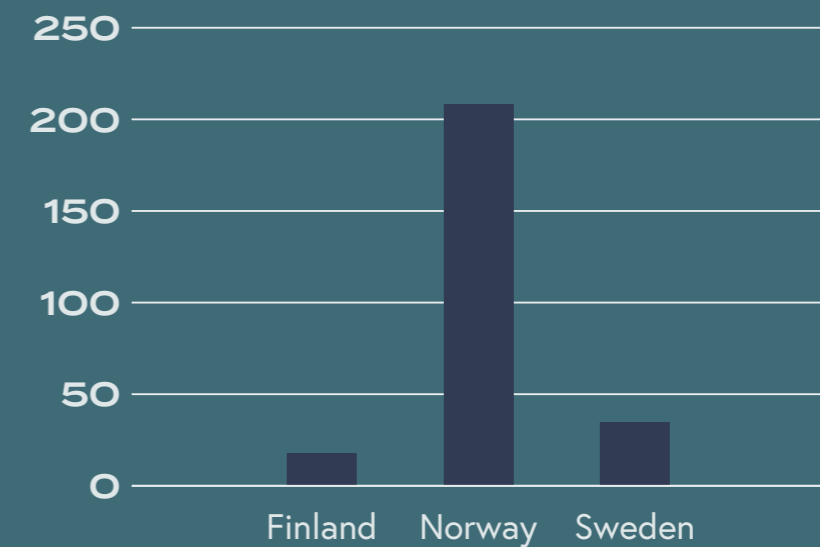


Figure 4: Indigenous production of energy, 1000 tonnes oil equivalents, 2016

Source: Nordic Statistics 2019a

4

Financial infrastructure

Countries

FINLAND

The major public institutions overseeing the financial sector are the Bank of Finland, the Ministry of Finance, and the Financial Supervisory Authority. The European Central Bank has an important regulatory role: although the major banks in Finland are Finnish or Nordic, and the money transfers they facilitate primarily domestic rather than international, the Finnish payment infrastructure is thoroughly European. The architecture is built around the Single Euro Payment Area (SEPA), which, excluding intra-banks transactions, facilitates the vast majority of all money transfers to, from, or within Finland. The SEPA includes all EU and EEA member states, and its main infrastructure is operated by France, Germany and Italy.¹⁴¹ Finland transitioned to the European payment architecture parallel to adopting the euro in 2008. In terms of the number of transactions, the SEPA standard is indispensable to Finnish payment transactions, although banks also use correspondent banking relationships for high-value money transfers.¹⁴²

141 European Central Bank (2020a): Single Euro Payments Area (SEPA).

142 Bank of Finland (2019): Taulukot.

The Finnish sector itself is bank-driven, and the banking sector centralised and large compared to the GDP.¹⁴³ The two dominant banks in terms of market share in savings, mortgages and corporate finance are Osuuspankki (38–40 per cent) and Nordea (27–30 per cent), which are also listed as significant and subject to direct European Central Bank supervision.¹⁴⁴ Danske Bank and Municipality Finance control minor market shares (9–12 per cent each), followed by a number of conventional and online banks.¹⁴⁵ Osuuspankki has most of its clients in Finland, and its two main competitors, Nordea and Danske Bank, treat the Nordic countries as their home markets. While cross-border payments are on the increase, most money transfers still take place between Finnish accounts.¹⁴⁶

143 Finnish Ministry of the Interior (2019): National risk assessment 2018, 39–41.

144 Municipality Finance is the third Finnish credit institution directly under ECP supervision. It lends exclusively to Finnish municipalities, their majority-owned companies, and non-profit housing companies.

145 Finance Finland (2019): Pankkivuosi 2018.

146 Bank of Finland (2019).

OVERVIEW

Financial market infrastructures comprise a vast whole including large value payment systems, retail payment systems, securities settlement systems, securities registries, central counterparties and trade repositories.¹⁴⁷ In this section, the main thrust is levelled

at systems used in large value and retail payments, which are central to societally vital transactions, such as pensions, social benefits, retail payments and salaries.¹⁴⁸ Finland, Norway and Sweden have taken up different approaches to ensuring the stability of the payment systems. Whereas Norway and Sweden have retained their

own national institutions, Finland has integrated into the European payment architecture. The countries also diverge in the sense that the use of cash is rapidly declining in Norway and Sweden.¹⁴⁹ Nevertheless, the three countries' financial sectors are interwoven together by major Nordic banks operating across the region.

147 BIS (2020): Principles for Financial Market Infrastructures (PFMI).

148 'Payment systems – payment infrastructures – refer to multilateral arrangements and systems that are used for transferring electronic payments between payer and payee.' Bank of Finland (2020): Payment systems.

149 Deloitte (2019): Chasing cashless? The rise of mobile wallets in the Nordics.

A trend affecting payments is the decreasing use of cash in Finland, although the transition is taking place less rapidly than in Norway and Sweden.¹⁵⁰ At the same time, money transfers are becoming faster. Consumers and firms have sought means to update money transfers to meet the needs of modern economies, in which most digital services, such as immediate messaging, take place in real-time. The EU directives and regulation have reinforced and facilitated this trend, urging financial institutions to strive for faster transactions in order to boost economic activity in the European Single Market.¹⁵¹ The introduction of new technologies also shapes the payment systems, for instance as banks consider which business functions they can operate based on a cloud-based infrastructure.¹⁵²

Finland's reliance for both international and domestic transactions on the European infrastructure distinguishes Finland from Sweden and Norway, which have retained national payment infrastructures even as they have adopted the SEPA standard. There is no national backup system akin to, for instance, Bankgirot in Sweden, which could clear and settle domestic, inter-bank transactions were Finland cut off from connections with the European infrastructure.¹⁵³ Although Finnish authorities have considered the need for a national solution, Finland's prevailing strategy remains to strengthen the European architecture instead of building a costly domestic alternative.¹⁵⁴

Various disruptions to the Finnish payment system may originate from abroad, as the cross-border nature of the infrastructure enables problems elsewhere to spread rapidly to Finland.¹⁵⁵ There are no easy ways to insulate domestic payments from such risks. Ensuring that physical linkages to European data centres – such as submarine cables in the Baltic Sea – remain functional is key to both domestic and international bank transfers. The EU is the primary platform on which Finland tries to ensure the func-

150 Deloitte (2019).

151 European Central Bank (2020b): What is TARGET Instant Payment Settlement (TIPS)?

152 Interview at a bank, Finland, 18 September 2019; interview at a bank, Finland, 26 September 2019.

153 Aaltola et al (2016), 127.

154 Ministry of Finance (2018): Varautumisvelvollisuutta rahoitusosalalla koskevan sääntelyn tarkistaminen.

155 In April 2018, a fire alarm at a data center in Visby, Sweden,

closed down the Nasdaq Helsinki exchange. Yle (2018): Nordic, Baltic stock exchange openings delayed by knockout of Nasdaq data centre.

tioning of the payment system. This is understandable, as the European Parliament and the Council of the European Union produce regulations affecting the Finnish financial system, and the European Central Bank serves many functions previously held by the Bank of Finland. Many elements of the SEPA architecture, such as the TARGET2 system, are classified as systemically important to the EU because of their vital role in all euro transactions, and are cushioned with multiple duplicate and safety arrangements.¹⁵⁶

NORWAY

At governmental level, the sector is headed by the Ministry of Finance, under which several subordinate agencies and authorities maintain their own allocated areas. These include, among others, Folketrygdfondet, which manages the Government Pension Fund; the Financial Supervisory Authority, which supervises actors in the sector; and the Norwegian Agency for Public and Financial Management, which assists with the central government's financial administration. The Central Bank of Norway also plays a large role in the sector, regulating the economy in the pursuit of financial stability. On the private side, 127 banks operate in Norway as of the end of 2018.¹⁵⁷ Among the largest are DNB, Sparebank 1, Nordea, Handelsbanken, and Danske Bank.¹⁵⁸ As in other sectors, digitalisation has major effects on financial infrastructures. Cash is being used less and less: in 2001, the portion of payments and money transfers handled entirely cashlessly was 89 per cent, whereas in 2018 it was 98 per cent.¹⁵⁹ In other words, of all payments occurring throughout the entire market system, only 2 per cent are completed in cash.¹⁶⁰

Foreign financial technology companies struggle to enter the payment markets, as the Norwegian banking and financial institutions cooperate to create inexpensive and efficient common infrastructure solutions. A central part is a set of services represented by three firms. The mobile payment system

156 Palva, Marianne (2015): Suomen Pankin rooli maksuliikkeen kehityksessä: kansallisista järjestelmistä yhteiseurooppalaisiin järjestelmiin, 33–34, 72–73, 88.

157 Norges Bank (2019): 2019 Finansiell Infrastruktur.

158 Finans Norge (2019): Banking sector.

159 Norges Bank (2019): 2019 Finansiell Infrastruktur.

160 Interview with Norges Bank, Norway, 2 October.

The digitalisation process is affecting the sector, and one of its major threads is the reduction in cash use.



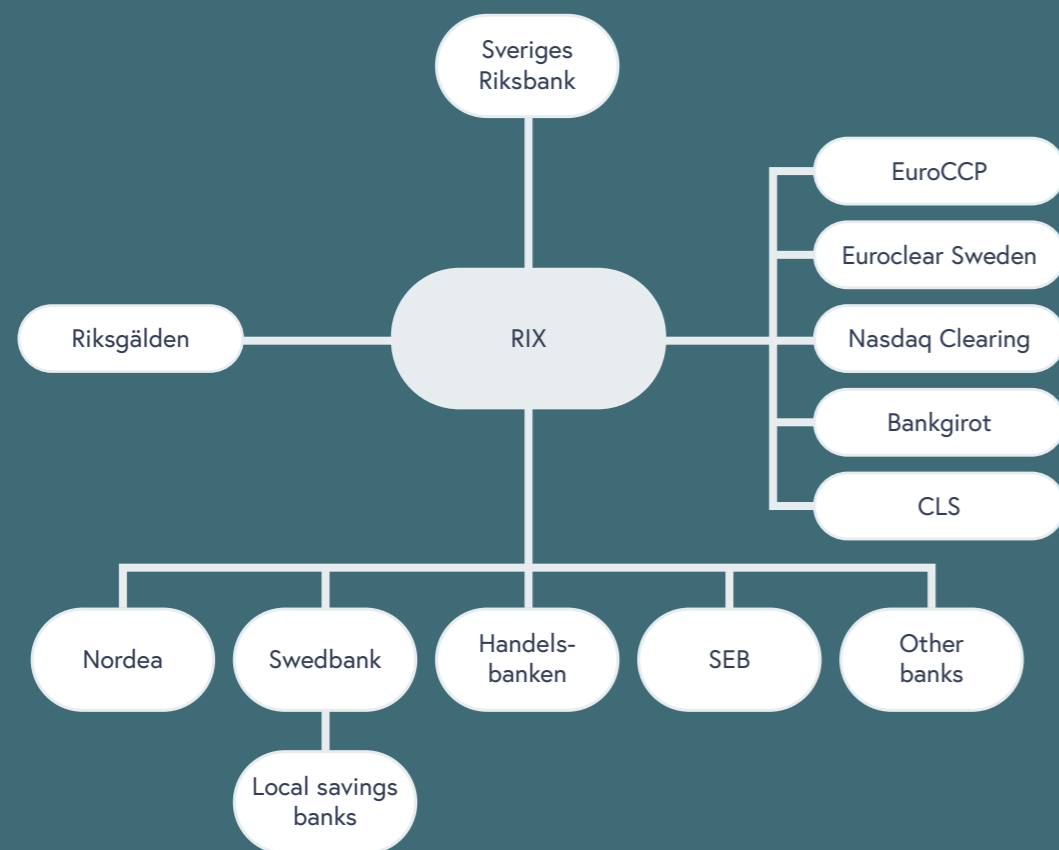


Figure 5: Participants in the large value payment system RIX

Source: Modified from Riksbank

Vipps, the digital identification and authentication system BankID, and the payment system BankAxept are infrastructures developed by the key banks and institutions in concert. The technological solutions are so consensus-based and streamlined that they have not, as of yet, been challenged.¹⁶¹

The Norwegian financial sector runs on largely national infrastructure, but it has evident cross-sectoral dependencies. Most direct, cashless financial transfers rely on energy supply and functioning telecommunications. Symmetrically, the sector is integral to commercial activities in all other sectors. Furthermore, because of the move towards cashless payments, the importance of inexpensive, efficient payment infrastructures is very high.

There appears to be a trend of appreciating the role of the financial sector in preparedness efforts, with financial institutions and organisations taking part in preparedness exercises, engaging in seminars on digital preparedness, and taking note of the increased scope of the revised national Security Act. The risks identified are diverse. For instance, the oil industry, the largest contributor to the Norwegian economy, is bound by law to have the lion's share of its profits held outside of the country. This means that Norway exports a huge amount of capital and is subsequently reliant on importing capital to cover basic economic necessities.¹⁶² This places a potential stressor on security of supply.

SWEDEN

The cornerstone of the financial market infrastructures in Sweden comprises of major systems for handling the clearing and settlement of payments and financial instruments. Riksbank, Sweden's central bank, is a key actor that provides the real time gross settlement system (RIX) for large value payments (figure 7). Financial institutions use this system to make payments among themselves. Riksbank is also responsible for the nation's supply, including the production and destruction, of coins and notes. In addition to this, the Swedish National Tax Office and several other authorities carry out tasks, provide services and operate systems important for the

financial sector.¹⁶³

Several private actors have a central role in managing the payment infrastructure. Euroclear Sweden AB is Sweden's Central Securities depository (CSD) and Securities Settlement System (SSS) provides the clearing and settlement of stock market and interest rates market, and to certain extent financial derivatives. Nasdaq Clearing AB provides a central counterparty clearing system for a range of markets and asset classes. The major banks are SEB, Danske Bank, Nordea, Handelsbanken and Swedbank, as well as Forex Bank and ICA Banken. Bankgirot (Bankgirocentralen BGC AB) provides retail payment systems and is the principal clearing organisation for retail payments in Sweden.

The digitalisation process is affecting the sector, and one of its major threads is the reduction in cash use. Swish is the leading system for retail payments in real-time in Sweden. The major banks jointly own the company Getswish, which provides the system. They also own Finansiell ID-Teknik BID AB, which in turn provides the principal electronic identification system, BankID, used by about 8 million people, authorities and companies on a regular basis for private and public digital services.

A potential concern regarding the reliance on the payment system is the foreign ownership of providers important to the Swedish financial market infrastructure. Some key functions, such as those related to clearing and settlement services, financial messaging, and large-value payments, are provided by companies headquartered elsewhere in Europe or beyond. Many of them, for instance the Belgian-based SWIFT or the US-based Nasdaq, also have operations in other Nordic countries. As in other sectors, foreign ownership does not by itself constitute a threat, as it can lead to efficiencies and provide assets and functions that would otherwise be unavailable. However, being aware of the foreign connections, and addressing potential disruptions to them in contingency planning, is an increasingly pivotal element of preparedness efforts in the sector.

Riksbank has made special agreements with suppliers of products and services, for instance regarding

¹⁶¹ Interview with Finans Norge, Norway, 11 October.

¹⁶² Interview with Finans Norge.

¹⁶³ e.g. the Swedish Tax Agency (Skatteverket), Finansinspektionen (Sweden's financial supervisory authority), Swedish Social Insurance Agency (Försäkringskassan), the Swedish Board of Student Finance (CSN), the Swedish Pensions Agency (Pensionsmyndigheten), the Swedish Public Employment Agency (Arbetsförmedlingen) and the National Government Service Centre (Statens Servicecenter).

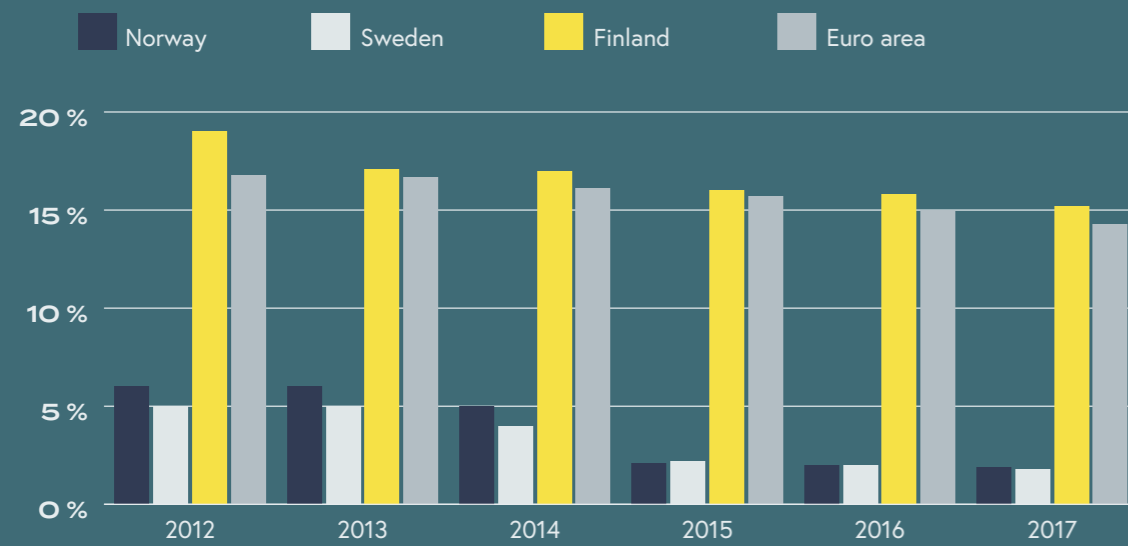


Figure 6: Cash as share of total money supply (M1), 2012–2017

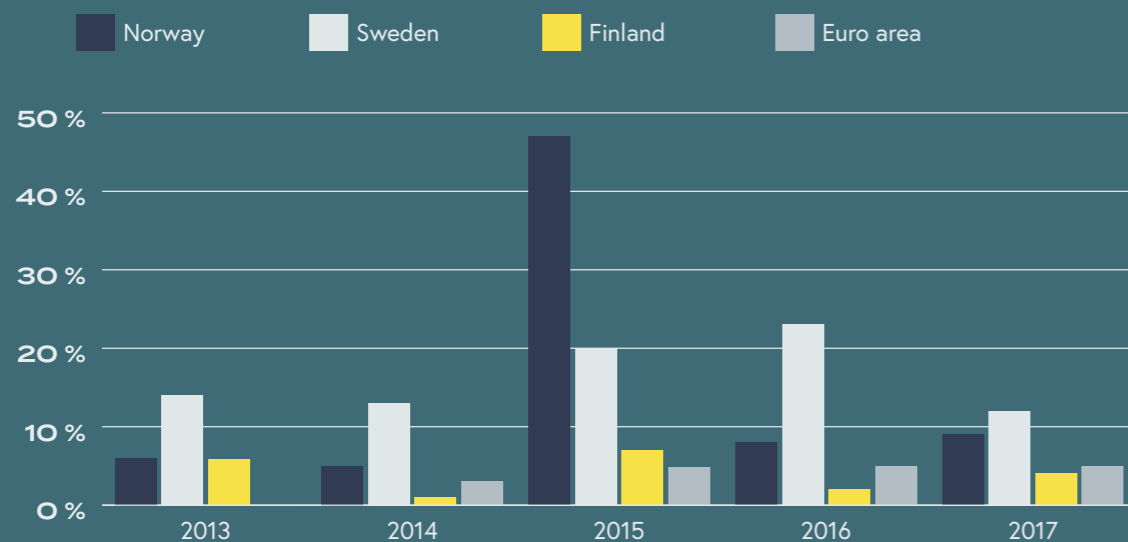


Figure 7: Annual decrease in cash as share of total money supply (M1), 2013–2017

Source: Deloitte 2019

the production of money in normal and exceptional circumstances. The agreements include both services for the agency's normal operations and specific preparedness measures.¹⁶⁴ There are several forums for preparedness and resilience cooperation within the sector. The Swedish Forums for Crisis Preparedness on Economic Security (SOES) coordinates disaster preparedness and civil defence activities initiated by the central governmental agencies in Sweden.¹⁶⁵ Its aim is to strengthen the responsible actors' ability to prevent and manage disruptions in socially important payment flows. The Swedish Financial Sector's Private-Public Partnership (FSPOS) is a voluntary cooperation forum with participants from the private and public actors in the financial sector, whereas the Forum for exchange of information on information security in the financial sector (FIDI-FINANS) aims to exchange information regarding cyber and information security in the sector.¹⁶⁶

Cooperation

Most of the European cooperation takes place within the SEPA standard. On the Nordic level, there are specific arrangements, such as the Nordic Financial CERT, which aims to strengthen the Nordic financial industry's resilience to cyber-attacks. Its member banks and institutions come from all five Nordic countries. The Nordic central banks also cooperate to some extent, informally sharing information and competence among each other. The exchange between the Finnish central bank and its Nordic counterparts on these issues has not been as extensive, presumably due to differences in the countries' payment systems.¹⁶⁷ Denmark, Norway and Sweden share the same software provider of payment system for large value payments, which fosters their exchange of experiences and the coordination of requests to the provider regarding customisation of the software.¹⁶⁸ Similar arrangements between Finland and other Nordic countries are less extensive: Finland uses the euro, and the European SEPA remains the standard

for Finnish payment transactions.¹⁶⁹

As an initial analysis, the three countries are likely to retain somewhat diverging measures to ensure the stability of their societally important large value and retail payments. Norway and Sweden have built their payments systems on national infrastructures, whereas Finland's relies on the European infrastructure. To provide some perspective, the major banks in the region have long acted as Nordic rather than national entities. For instance, since 2018 a group of Nordic banks and Mastercard, a financial services company, have worked on P27, a platform for real-time and cross-border payments in the Nordic countries.¹⁷⁰ As part of contingency planning, the project is to run on several IT platforms located across the Nordic countries.¹⁷¹ The slight asymmetry between nationally based systems and the thrust of the private sector to develop regional schemes characterises prospective future cooperation schemes.

The direction of collaboration between the national authorities remains unclear. Norway took part in the early discussions surrounding the P27 project, but the board of the Norwegian financial industry organisation, Finance Norway, decided to abandon the Nordic P27 initiative and focus on further improving the domestic financial infrastructure.¹⁷² Accordingly, the Norwegian authorities have expressed little interest in deepening collaboration with their Finnish and Swedish counterparts. In Sweden, the national payment system faces costly updates, which has created at least an initial discussion on the prospects for cross-border collaborations on payment infrastructure. Illustratively, the Swedish banking sector has been more interested in pursuing the P27 initiative. Hypothetically, a Nordic payment platform could serve as a mechanism through which at least some vital Finnish payments, both domestic and international, could be channelled were the SEPA connections disrupted. For now, however, the Finnish banks are advancing the P27 initiative based on a commercial logic.

¹⁶⁴ Interview at Riksbank.

¹⁶⁵ MSB (2016b): Samverkansområdet Ekonomisk säkerhet (SOES).

¹⁶⁶ FIDI-FINANS stands for the 'Forum för informationsdelning om informationssäkerhet i finanssektorn'. Translation authors' own.

¹⁶⁷ Interview at Riksbank.

¹⁶⁸ Interview at Riksbank.

¹⁶⁹ Interview at the NESÄ, Finland, 8 May; Finnish Ministry of Finance (2018).

¹⁷⁰ P27 (2020): P27 Nordic Payments.

¹⁷¹ Interview at the Swedish Bankers' Association, Sweden, 22 October.

¹⁷² Gjerdal, Eivind (2019): Felles evaluering av mulig deltakelse i P27-initiativet avsluttes i Norge.

Discussion

This section compiles some proposals for further collaboration. Although the countries have differing starting points, this diagnosis might change in the future, as the cross-border linkages between the financial sectors of the three countries grow ever denser. The major banks are already Nordic entities, and their competition to stay on top of the digitalisation trend will shape the existing payment systems. Accordingly, one measure that could be taken by the national authorities is **to potentially formalise and strengthen the dialogue with each other and the private sector regarding the potential preparedness implications of any Nordic payment solutions**. Furthermore, as especially Norway and Sweden are experiencing a shift towards becoming cashless societies, another joint action could be **to improve their exchange of information and best practices regarding risk management in societies reliant on digital money transfers (figures 8 and 9)**. Finally, while the focus in this report has been on payment systems, they comprise merely one element in the societally vital financial market infrastructures. A third measure the three countries could take is **to support cross-border collaborative entities, such as the Nordic Financial CERT, to identify common challenges in the financial market infrastructure as a whole**. Further arrangements between the relevant national authorities, such as staff exchange and formal communications lines on preparedness issues between the central banks, can also be elements in deeper trilateral collaboration, provided that they are judged as worthwhile in each country.



**...the major banks
in the region have
long acted as
Nordic rather than
national entities.**

5

Food

Countries

FINLAND

The proportion imported content accounts for in the Finnish food market has grown over the last 15 years. Although many food products are made in Finland, their production takes advantage of inputs brought in from abroad. These inputs include chemicals and chemical products, such as plant protection products; general disinfection and cleaning agents; raw materials, such as plants, grasses and crops; semi-manufactured products, such as soya protein; and energy, often in the form of crude oil, coal, natural gas and refined oil products.¹⁷³ Additionally, specialised machinery, such as vehicles for transporting livestock, often originates from abroad. Many food inputs stem from or arrive through the EU, reaching Finland through Amsterdam, Rotterdam and other big European ports.

Nevertheless, the Finnish food sector remains less

173 Knuutila, Marja and Eero Vatanen (2015): Elintarvikemarkkinoiden tuontiriippuvuus, 5; Kaustell, Kim et al (2017): Sähköjakeluhäiriöiden vaikutukset elintarviketuotannon jatkuvuuteen, 3.

dependent on imports than the respective sectors in, for instance, Sweden and Denmark. Even if many intermediate inputs stem from abroad, a significant proportion of the items on the food market are produced domestically. Exact percentages depend on the calculation method used, some ranging between 72 and 75 per cent.¹⁷⁴ Finland exports grain, and its meat and dairy production meets the domestic consumption, indicating that most products in an average Finnish food basket are or can be produced in the country.¹⁷⁵

Food distribution for final consumers is highly centralised. Two companies, the K and S Groups, manage their networks of distributors and retailers, controlling 36 per cent and 46 per cent of the grocery retail sales in Finland, respectively. Lidl, a recent entrant, has captured 10 per cent of the markets.¹⁷⁶ All three chains source food products from Europe and beyond, either individually or teaming up with other, international retail chains to land better deals with producers.

174 Knuutila, Marja and Eero Vatanen (2015), 5; Lehtikoinen, Elina and Matti Kumm (2017): Challenges in Nordic food security – A case study of Finland.

175 Interview at the NES, Finland, 2 May.

176 Finnish Grocery Trade Association (2018): The grocery trade market in Finland.

OVERVIEW

This section centres around activities to produce, process and distribute food to consumers, especially primary production, food processing and retail.¹⁷⁷ Finland, Norway and Sweden all import food products, mainly from the EU area. Domestic food producers rely on production inputs, such as

fuels, fertilisers, packaging materials and spare parts, as well as on IT systems and other operations, sourced from abroad. The largest producers operate across the Nordics, buying from and selling to markets beyond their home country. The food sector is also increasingly dependent on access to energy, transport and financial services. Agriculture, aquaculture

and food industry actors harness new technologies to increase productivity and outputs.¹⁷⁸ Companies grow into large units, specialise into specific products, and favour a 'just-in-time' type of supply instead of long-term storages.¹⁷⁹ Amidst these changes, Finland, Norway and Sweden have retained largely national measures to ensure their supply of food.

177 Drinking water has not been addressed in this report, as few collaborative arrangements were identified during the research. A need for a re-examination of the Nordic water supply might be created by climate change, e.g. Marttunen, Mika et al (2019): 'A framework for assessing water security and the water-energy-food nexus – the case of Finland' in Sustainability, 11(10).

178 DSB (2017): Risiko- og sårbarhetsanalyse av norsk matforsyning; Lantmännen (2019): Framtidens jordbruk.

179 Interview with NFD Norway, 24 September.

...contemporary challenges to food security are characteristically cross-sectoral.

Finnish food production is also characteristically run by several major companies, such as Valio and Fazer, with their own established market segments. The producers operate across the Nordic countries. To illustrate, in terms of ownership and market areas, Yara, a major chemical company partially owned by the Norwegian state, produces fertilisers in Finnish factories, and HKScan and Atria, meat and food producers, have a strong presence both in Sweden and Finland.

Weather affects food supply in different ways: storms occasionally slow down maritime cargo deliveries in the Baltic Sea, and draughts have caused financial losses to farmers in the Baltic region. Agriculture takes place across the country, exposing the northern farms to colder weather conditions than producers in Sweden, where agriculture is concentrated in the south.¹⁸⁰ However, contemporary challenges to food security are characteristically cross-sectoral. Disruptions in Finnish access to food supplies may involve power outages in major European harbours, cyber-attacks against the digital systems of the distribution centres, or malfunctions in payment platforms used in grocery stores. Rapid changes in local or regional demand, for instance due to epidemics or mass evacuations, are some examples of events that would complicate efforts to ensure food supplies to the whole population.¹⁸¹

Finland has stable national arrangements in place to maintain its supply of food. The grain storages owned by the Finnish state, together with reserves held by wholesale operators and farmers, could meet the average consumption for more than 12 months. The NESAs and the Finnish Food Authority, two state agencies overseeing preparedness efforts in food security, maintain close collaboration, involving

scenario-building and exercises, with major producers and retailers. The EU's agricultural subsidies also help support Finnish domestic production of staple food in the integrated European markets. Finland's relatively strong agricultural production, while dependent on access to energy, transport, IT services, and other inputs, forms the basis of Finnish preparedness efforts in food security.

NORWAY

In broad terms, Norwegian meat and dairy production can cover the national demand, and Norway is entirely self-sufficient in fish (figure 5). However, in the supply of grains, fruits and berries, vegetables, sugar products and, importantly, feed, the country relies on imports. A large portion of the imported inputs consists of feed for fish and meat production. The EU Member States, especially in northern Europe, provide a major share of the imported agricultural products.¹⁸²

Domestic producers encompass a wide range of actors, such as Tine Producers, Orkla and Mondelez.¹⁸³ There are three major grocery-chains in Norway: Coop, Rema and Norgesgruppen. These grocery chains manage their own distribution. In addition to this, Servicegrossistene and Tine Distribusjon also distribute food products. The commercial grocery chains also have contracts with international suppliers, but retain a decidedly domestic focus, as the Norwegian producers are well acquainted with national dietary preferences and food norms.¹⁸⁴

The governmental responsibility in Norway for food rests mainly within three ministries. The Ministry of Trade, Industry and Fisheries (NFD) coordinates

180 Interview at the NESAs, Finland, 2 May.

181 Holopainen, Viljo (2017): Ruokapalvelut osana päivittäistavara- ja elintarvikkeiden huoltoa; Finnish Ministry of the Interior (2019), 61–63.

182 DSB (2017).

183 Interview with NFD.

184 Interview with Orkla, Norway, 23 September.

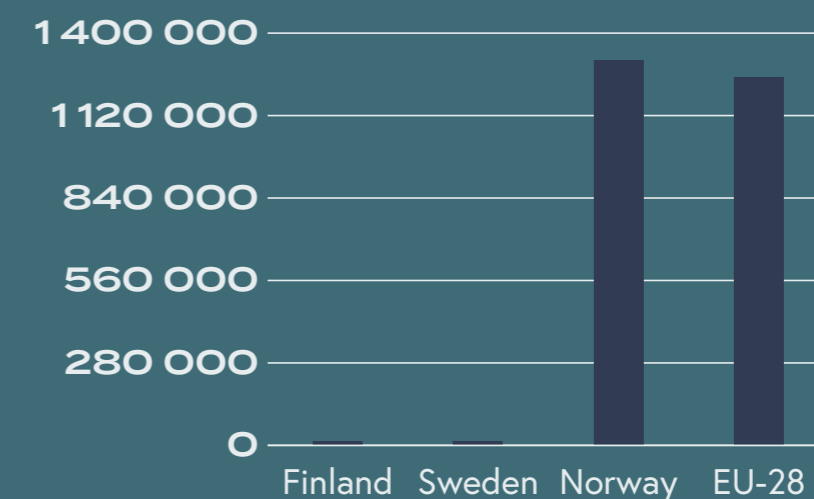


Figure 8: Aquaculture production, tonnes of live weight, 2017

Source: Eurostat 2018b

food supplies in the event of a crisis, and preparedness efforts in fishing, ocean farming, food industries and distribution of food products. NFD also follows up on the fourth of NATO's Seven Baseline Requirements on resilient food and water resources.¹⁸⁵ The Ministry of Agriculture and Food (LMD) coordinates preparedness efforts in farming, and monitors the agricultural markets in order to ensure the continuation of supply of agricultural products in a crisis, which means enabling Norwegian production and supplementing demand with imports. The Ministry of Health and Care Services (HOD) also bears responsibility within the area of food quality.¹⁸⁶ In addition to these ministries, there are underlying authorities and directorates with relevant responsibilities, such as the Directorate of Fisheries, the Norwegian Agriculture Agency and the Food Authority.¹⁸⁷

To a considerable extent, Norway will rely on market forces in a crisis.¹⁸⁸ Contact between NFD and the producers is less formalised than the contact between the ministry and distributors. NFD has compiled a thorough but limited list of producers, representing the breadth of the Norwegian average diet, with whom it regularly engages on preparedness issues.¹⁸⁹ Three companies, Nortura, Norske Felleskjøp and TINE, are market regulators who monitor the Norwegian supply of domestically produced foods. These are cooperative-owned ventures by Norwegian producers. Among other things, they compare the supply of Norwegian products to market demand, and advise the Norwegian Agriculture Agency on whether to open up for more imports, mainly by lowering customs duties.¹⁹⁰

The authorities also possess other tools. The Act on Business and Industry Preparedness, for example, allows for the government to institute a 'special measures order', which can bypass markets, regulations and other limits to ensure supply.¹⁹¹ This option is considered only in the utmost necessity. Furthermore, restoring long-term storage of grain to ensure supply has been debated in recent governmental budget discussions. However, LMD argues that

imports and the national production of grain can be sustained in a crisis. Supplementing Norway's self-sufficiency in terms of fish, these two sources of food will be enough to keep an acceptable level of supply. The ministry considers a complete halt in grain imports unrealistic. In the event of shortage of supply, Norway considers itself capable of keeping up with price increases.¹⁹² Norway enjoys access to a series of markets through WTO, EFTA and EEA agreements. No budget funds have therefore been allocated for long-term grain storage.

SWEDEN

Cereals, mostly wheat, barley and oats, as well as grassland for fodder, dominate the domestic crop production. Due to different climate conditions, the regional preconditions for production vary greatly. In southern Sweden, oil seed and sugar beet dominate, whereas potatoes are grown in the northern parts. Horticultural production of fruits, vegetables and berries takes place primarily in the south of Sweden. The dairy and livestock sectors, including the production of cattle, sheep, pigs, fowls and chickens, play a central role in Swedish agriculture.¹⁹³

Food processing is one of Sweden's largest industry sectors. Although the sector consists of a large number of small companies the food production is concentrated in a handful of larger, often internationally operating companies.¹⁹⁴ Some of the largest companies in the Nordic countries that operate on the Swedish market are Lantmännen AB, Fazer, Orkla, HK Scan and AKK. Many trademarks on the Swedish market are owned by the agricultural cooperative Lantmännen AB, a major player both in Swedish and European markets. The food retail market is divided between six companies: ICA gruppen AB, Axfood AB, Coop AB, Bergendahls AB, Lidl AB and Netto AB, the first of which is the dominant actor with approximately half of the market share, followed by Axfood AB and Coop AB. Together, the three firms controlled 86 per cent of the markets in 2018.¹⁹⁵ Besides these actors there are also several companies acting on the Swedish market for food service. Several of the larger

companies within food service are owned by large international companies located in other countries.

The term 'Swedish market share' can be used to describe the relationship between the production in Sweden of a specific product and the total sales of that product on the market, expressed in quantity. Based on such calculations, it is evident the production of primary products can meet the national demand for several products, such as in grain, milk and certain vegetables. Domestically produced meat, dairy and eggs also retain a high share in the markets. But for several other products Sweden is to a large extent dependent on imports.¹⁹⁶

During the period 2008–2018, the imports of food and agricultural product increased by approximately 6 per cent annually. These imports mainly originate from other EU countries. In 2018, imports from the Nordic countries, measured in economic terms, totalled 15 per cent from Denmark, 3 per cent from Finland and 2 per cent from Norway. Sweden also exports food and agricultural products to other Nordic countries: 20 per cent of the total value of the export is due to export to Norway, 15 per cent to Denmark and 11 per cent to Finland.¹⁹⁷ Besides trade in food and agricultural products the Swedish food sector has many other international linkages, for instance though the ownership of the companies and dependencies in the production and distribution of food products.¹⁹⁸

No major shocks have affected the supply of food in Sweden in recent decades, although minor disruptions have served as reminders that vulnerabilities exist. In 1998, a snowstorm in Gävle hindered food distribution, in 2002 a large power failure in a suburban Stockholm area made it difficult for 50 000 individuals to store and prepare food, and in 2018 a drought put pressure on Swedish farmers, affecting the harvest and their ability to feed the livestock.

As in other sectors, while companies' primary responsibility is to fulfil their contracts with other companies and clients, Swedish legislation requires public agencies to reduce the vulnerabilities of soci-

ety and to develop a capacity to perform their tasks even during crises and war.¹⁹⁹ The Swedish Food Agency, the Board of Agriculture and the National Veterinary Institute (SVA) are the three major public agencies with relevant responsibilities in the food sector. In 2010, the Swedish Food Agency was assigned formal responsibility for coordinating and planning crisis and preparedness activities within the food sector, excluding primary production.²⁰⁰ The agency facilitates studies within the area of security of supply for food, and organises regular meetings for representatives from public agencies and private companies to discuss the topic. Apart from this, some public actors have specific responsibilities for providing food for persons within their care, for instance hospitals and schools.

Cooperation

On a continental level, food security is one of the foundations of the EU's Common Agricultural Policy. NATO provides a venue in which Nordic and Baltic countries, especially NATO member states, have an opportunity to cooperate regionally on food security, however Nordic cooperation on the theme remains rather light. National authorities and other actors in the food sector, often bilaterally, meet and exchange knowledge in the area of crisis management and security of supply.²⁰¹ Many activities are informal; for instance, Finland and Norway have discussed food logistics from and to northern Norway, although their bilateral agreement on the exchange of goods and services in crisis and warlike circumstances does not specify food security as a theme for cooperation.²⁰² However, it is informally understood that they would also cooperate in food shortage scenarios should the need arise. Equally, Norway and Sweden have a bilateral agreement on trade in times of crises, but it is largely considered outdated and non-functional, and does not directly address food security. Finland and Sweden have a similar agreement.

185 Roepke, Wolf-Diether and Hasit Thankey (2019): Resilience: The First Line of Defence. The Three Swords Magazine.

186 Apart from the quality of fish, which is part of NFD's portfolio.

187 DSB (2017); interview with NFD.

188 Interview with Orkla.

189 Interview with NFD.

190 DSB (2017).

191 Norway (2012): Act on Business and Industry Preparedness.

192 NTB (2019): Regjeringen dropper beredskapslager av korn.

193 Statistics Sweden (2019): Agricultural statistics 2019 including food statistics – tables.

194 Swedish Food Federation (2019a): Fakta och statistik.

195 DLF (2019): Dagligvarukartan 2019.

196 Swedish Food Federation (2019b): Hur stor andel av livsmedlen som säljs på marknaden är producerade i Sverige?

197 Swedish Food Federation (2019c): Svensk handel med jordbruksvaror och livsmedel 2018.

198 Krisberedskapsmyndigheten (2007): Beroende- och konsekvensanalys av livsmedelsförsörjningen. Offentligt arbetsmaterial från KBM:s projekt Samhällskritiska beroenden;

Eriksson, Camilla (2018): Livsmedelsproduktion ur ett beredskapsperspektiv: Sårbarheter och lösningar för ökad resiliens.

199 Sweden (2015a).

200 Sweden (2009): Förordning (2009:1426) med instruktion för Livsmedelsverket.

201 Eriksson, Camilla, Pär Eriksson and Johanna Wahrenberg (2018): Internationella avtal och samarbeten med relevans för civilt försvar. FOI; Dover, Ann-Sofie Stenérus, Anders Odell, Per Larsson and Johan Lindgren: Beredskapslagring. FOI; MSB (2018): Så bygger vi säkerhet i Norden: Ett svenskt myndighetsperspektiv.

202 Interview with NFD.

To provide a brief analysis, the three countries maintain their distinct food security policies. To a different extent and in different ways, they strive to ensure that they can draw on alternative sources in the global food markets if the established commercial agreements are disrupted, and that they can step up their domestic, relatively efficient food production if wider issues in imports occur. Surely, the countries' arrangements and their scope differ. Finland has retained grain storages for decades, whereas Norway and Sweden have had them disassembled, choosing to rely on the global grain market and alternative sources of nutrition. Norway can compensate for its relative lack of arable land per capita through its extensive resources for fishing (figures 8 and 9). From a comparative perspective, their positions are relatively stable, notwithstanding that each country retains dependencies on imported production inputs, such as fertiliser, feed, and machinery, from each other and third countries, and cross-sectoral dependencies, such as on access to electricity, stable IT systems, and open transport routes, at different stages of the food supply chain.²⁰³

Discussion

This section presents some potential trilateral measures that emerged during the research. An interviewee makes a call **to institutionalise the communication between the agencies of respective Nordic countries, creating a framework for more structured interaction and dialogue.**²⁰⁴ More institutionalised cooperation could make it easier for the authorities to operate on similar planning assumptions, as well as to maintain collaboration in the longer run. A further action would be **to conduct a joint investigation on the foreign input contents of food production in Finland, Norway and Sweden.** Such a study could be built on a research conducted at the Natural Resource Institute Finland, which uses statistical input-output data from Finland, Sweden and Denmark.²⁰⁵ The investigation could also include looking into individual production inputs, such as farm machinery or fertilisers, which might be acquired from the same sources in all countries, or, for instance, into cyber networks connecting the countries' food sectors, as many large food producers operate across the Nordics. Another theme would be **to enhance the sharing of best practices regarding food security in each country.** For instance, Finland is enhancing the resilience of its food distribution channels by ensuring that more than 300 retail shops retain access to electricity during power outages and other disruptions. Such schemes could be replicable in other countries.

Another area of interest identified would be **to examine the regulatory standards in each country to ensure that potential trade or the delivery of stocks can take place if access to food products in one country is disrupted.** Finland, Norway and Sweden have their national standards related to packaging, food hygiene and production, which might prove an obstacle for cross-border cooperation in crises. Further challenges needing collective action might emerge in the future. A far-reaching measure would be **to conduct a study on the impact of global warming on food security in the three countries.**²⁰⁶ For instance, new, globally spreading plant and animal diseases might call for joint measures to prevent contagion.

203 Economist Intelligence Unit (2020): The global food security index.

204 Interview at the Swedish Food Agency, Sweden, 26 August.

205 'Tuonti III', an update to Knuutila and Vatanen (2015), is currently planned.

206 Cf. Economist Intelligence Unit (2020).

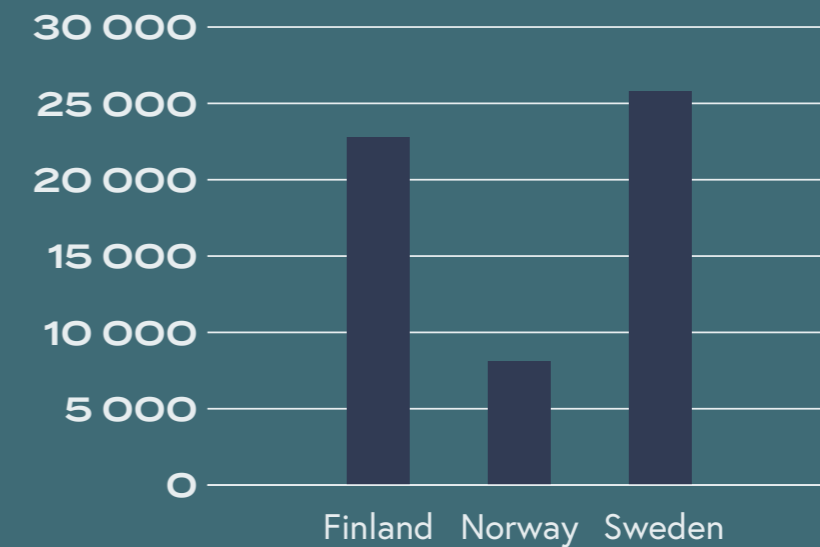


Figure 9: Arable land and gardens, square kilometres, 2016

Source: Nordic Statistics 2019b

6

Pharmaceuticals

Countries

FINLAND

Finland relies considerably on imports of medicines, and drugs produced domestically are not 'essential medicines' satisfying the priority healthcare needs of the population, but, for instance, hormone products, eye drops and pain killers.²⁰⁷ While some domestic producers, such as Orion, are owned predominantly by Finnish entities, many are under international or Nordic ownership. Imported pharmaceuticals are manifold and produced outside Finland by major global companies, for instance Johnson & Johnson, Novartis, Bayer and GlaxoSmithKline, which are large enough to bear the significant investments needed to develop and commercialise medicine.²⁰⁸

The Finnish system for distributing medicine is extremely concentrated. Two companies, Oriola and Tamro, the former of which is predominantly under Finnish ownership and the latter a part of Phoenix, a major European pharmaceutical trader, control the market country-wide. After the producers have assessed the expected demand, the distributors

channel pharmaceuticals on the producers' behalf to pharmacies, hospital pharmacies and medicine dispensaries. Although the Finnish legislation dictates that pharmacies are to be owned by independent pharmacists, it allows for collaborative arrangements between the pharmacies, and a number of branches of Yliopiston Apteekki, a university-owned pharmacy.²⁰⁹

In principle, Finnish preparedness efforts ensure the availability of those medicine that satisfy three conditions: they are critical in the sense that stable access to them is needed for saving and maintaining lives; 'crisifying' in the sense that access to them has a high risk of being disrupted; and crisis-specific in the sense that their demand is likely to rise during emergencies. For instance, antibiotics and anaesthetics satisfy the three conditions. However, other products, such as diabetes and heart-related medicine, are also considered in the preparedness efforts.²¹⁰

207 Lääketeollisuus (2019): Tilastot; World Health Organization (2020): Essential medicines.

208 Interview at the NESAs, Finland, 7 May.

209 Association of Finnish Pharmacies (2019): Annual review 2018, 18–19.

210 Interview at the NESAs, Finland, 7 May.

OVERVIEW

This section focuses on challenges to security of supply linked with the globalisation of the production of pharmaceuticals for human use. The production of medicines is becoming concentrated at key factories often located outside

Europe, such as in China and India. Symmetrically, domestic production in Finland, Norway and Sweden is scarce, as the countries have come to rely on the international markets. A global problem affecting the three countries alike has been the increasing number of shortages, which are a combined

result of several factors linked with market dynamics, regulation, and intellectual property rights.²¹¹ As small economies dependent on the global industry, it is difficult for Finland, Norway and Sweden to resolve such challenges alone.

211 Acosta, Angela et al (2019): 'Medicine shortages: Gaps between countries and global perspectives' in *Frontiers in Pharmacology*; Gautam, Ajay and Pan, Xiaogang (2016): 'The changing model of big pharma: impact of key trends' in *Drug Discovery Today*, 21(3); Economist (2019): A dire scarcity of drugs is worsening, in part, because they are so cheap.

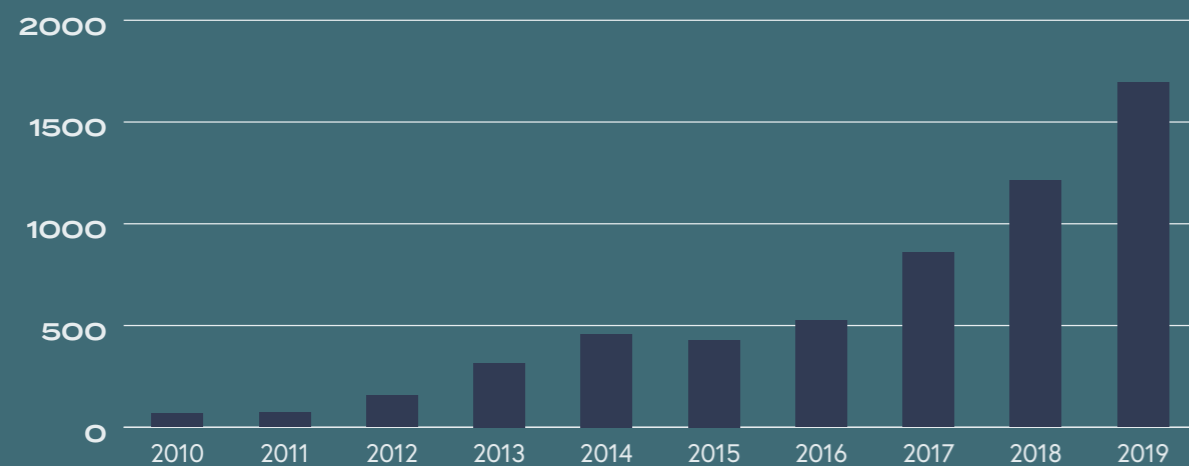


Figure 10: Medicine shortage notifications from marketing authorisation holders to the Finnish Medicines Agency, 2010–2019.

Source: Fimea 2020; Sarnola and Linnolahti 2019.

The main public agencies involved with the preparedness efforts are the NESAs; the Finnish Medicines Agency (FIMEA), which supervises and develops the pharmaceutical sector from a population health perspective; and the Finnish Institute for Health and Welfare, steering the national vaccination programme.²¹² As part of national efforts, importers of pharmaceuticals have a legal obligation to stockpile specific human and veterinary drugs to an extent that satisfies 3, 6 or 10 months' average consumption.²¹³ Some critical medicines are also stockpiled by state agencies, and the NESAs retain means to procure medicine rapidly from the international markets, as it did during the global spread of bird flu in 2006.²¹⁴

In Finland, attention has recently been paid to the distributors' data management and logistical systems, a failure in which can lead to shortages of medicine in pharmacies and hospitals.²¹⁵ The NESAs have facilitated cyber security updates in the health sector.²¹⁶ As elsewhere in Europe, many contemporary problems in the availability of pharmaceuticals originate from disruptions in the increasingly complex and globally dispersed supply chains. Although retaining access to international markets is a cornerstone of Finland's strategy in ensuring a supply of pharmaceuticals, Finland has little control over medicine production taking place beyond its borders. Multinational companies are not likely to prioritise small markets during shortages, as they distribute their pharmaceuticals unevenly among numerous buyers. The obligatory stockpiling in Finland provides a cushion against potential disruptions, but retaining the country as a market and destination for pharmaceuticals in a situation in which global production lines are exposed to diverse risks remains a challenge in the foreseeable future (figure 10).

212 The National Supervisory Authority for Welfare and Health (Valvira), the Finnish Food Authority, and the Radiation and Nuclear Safety Authority have some affiliated responsibilities.

213 Finland (2008): Lag om obligatorisk lagring av läkemedel.

214 Interview at the NESAs, Finland, 7 May.

215 Oriola (2017): Oriola Corporation's third quarter result impacted by distribution disruptions in Finland.

216 NESAs (2019b): Kyber-terveys -hanke valmistuu.

NORWAY

Norway relies on the global markets for most pharmaceuticals.²¹⁷ Some domestic companies produce pharmaceuticals sold abroad, however, domestic production is also dependent on imported precursors and active ingredients.²¹⁸ The trend towards internationalisation also affects storages: to reap economies of scale, global producers centralise the distribution centres to logistically convenient areas, whereby the storage centres remaining in Norway are run privately by third-party actors.²¹⁹

In Norway, pharmaceuticals are distributed to patients in four ways: i) through the receipt of a prescription at a pharmacy or through home care services; ii) through communal services; iii) through hospitalisation; or iv) through the Armed Forces health service. All four avenues except the first require a contract with either the pharmacy chains or the wholesalers. The pharmacy chains are owned by and serve as sales points for the wholesalers, which include Alliance Healthcare, Apokjeden Distribusjon, and Norsk Medisinaldepot, which is owned by the private company Celesio.²²⁰

The Ministry of Health and Care Services (HOD) is responsible overall for the security of supply of pharmaceutical products, and the Directorate of Health (Hdir) subordinate to the ministry coordinates the activities with other actors. The Institute of Public Health (FHI) handles the supply of vaccines and advises on the storage of antidotes in hospitals. The Norwegian Medicines Agency monitors and supervises the security of supply of pharmaceuticals in practice.²²¹

The public Regional Health Authorities (RHFAs), which are in charge mainly of hospitals, smaller health trusts (HFs) and some pharmacies, have a duty to ensure the availability of pharmaceutical supplies for specialist health services. These RHFAs own specific HFs in charge of hospitals' acquisitions to gather offers of pharmaceuticals used in the service.²²² There is, in addition to this, a National Centre for Shortages of Pharmaceuticals and Pharmaceuti-

217 DSB (2018a): Risikoanalyse av legemiddelmangel.

218 Norwegian Directorate of Health (2019): Nasjonal legemiddelberedskap: Vurderinger og anbefalinger.

219 Interview with Hdir, Norway, 26 September.

220 Norwegian Directorate of Health (2019); interview with Hdir.

221 Norwegian Directorate of Health (2019).

222 Ibid.

cal Preparedness in the Specialist Health Care Services, located within the University Hospital of Oslo, which monitors the supply situation of pharmaceuticals weekly.²²³

Producers of pharmaceuticals are obligated and wholesalers are encouraged to report disruptions to supply. In cases of disruptions, it is mainly the wholesalers, together with the Norwegian Medicines Agency, who work to procure a new supply. Supply is a commercial issue, where producers and wholesalers seek their own contracts. When the RHF's purchase pharmaceuticals, they do so on through bidding contracts, and are compelled to seek out inexpensive solutions. This means that during disruptions, control remains largely in commercial hands, with operators thereby having a much greater freedom to set prices. In turn, this could in some cases mean that problems of national supply are supplanted by problems of commercial access, since Norwegian purchasers are restricted in following rising prices.²²⁴ In other words, profit could trump public welfare.

SWEDEN

Supply of medicinal products in Sweden is part of and dependent on the global market. While some medicinal products are produced domestically, most domestic producers are owned by foreign actors, and production is not reserved for Swedish needs. Medicinal products are predominantly imported.²²⁵

There are two main channels for patients for getting access to medicinal products: the caregivers (mainly county councils) and the retail pharmacies. The supply chain of these outlets is based on a 'just in time' logic: deliveries are small and continuous whereas stocks are small. In practice, two large distribution companies perform all deliveries of medicinal products nationally.²²⁶

Since Sweden is dependent on imports of medicinal products, the country's access to pharmaceuticals is exposed to disruptions in global supply

chains.²²⁷ Often, the problems relate to miscalculations, quality defects or changes in the production process, shortages of active substances, or unexpectedly high demand.²²⁸

Sweden has no national actor responsible for the security of supply in medicinal products, but instead the responsibilities are divided between many different actors, some of which have obligations under preparedness legislation.²²⁹ Key public actors on the supply of medicinal products during crises are the National Board of Health and Welfare (Socialstyrelsen) and the Health and Social Care Inspectorate (Inspektionen för Vård och Omsorg). The former is required to coordinate and supervise preparedness planning of civilian healthcare and social services, as well as to coordinate preparedness planning for supply of medicinal products and medical devices.²³⁰ As the latter supervises Swedish healthcare, and caregivers are required to provide high quality care during crises, too, the security of supply is formally under the Inspectorate's supervision.²³¹ Additionally, the Public Health Agency of Sweden (Folkhälsomyndigheten) and the Medical Products Agency (Läkemedelsverket) have certain responsibilities in the sector.

As a part of the former total defence of Sweden, medicinal products were stockpiled in the case of war or a war-like situation. With some minor exceptions, these stockpiles have now been dismantled, and clear or regulating public goals regarding the availability of medicinal products, specifying for instance a reasonable level of security of supply, do not exist.²³² Current legislation also sets obstacles to such measures: county councils are prohibited from sharing medicinal products among themselves or with other countries, even during shortages, because they lack wholesale licenses.²³³

While strict regulations exist to ensure that medicinal products are effective and safe to use, Sweden has less regulation to secure their sup-

223 Interview with Hdir.

224 *ibid.*

225 Swedish National Audit Office (2018): Livsmedels- och läkemedelsförsörjning – samhällets säkerhet och viktiga samhällsfunktioner, 45, 47; Leth, Eva, Åsa Ek and Karin Lundgren Kownacki (2019): Resursförstärkt läkemedelsförsörjning inför kris, höjd beredskap och krig, 41, 58.

226 Swedish National Audit Office (2018), 45–47.

227 Leth, Eva, Åsa Ek and Karin Lundgren Kownacki (2019), 62–64, 72–74.

228 Medical Products Agency (2015): Restnoteringar av läkemedel – fortsatt utredning, 4, 21–25.

229 Interview at the National Board of Health and Welfare, Sweden, 5 September; Sweden (2015c).

230 Sweden (2015c): Förordning (2015:284) med instruktion för Socialstyrelsen.

231 Swedish National Audit Office (2018), 53–4.

232 Swedish National Audit Office (2018), 7–9, 46–47, 56–57, 67–68.

233 Interview at the National Board of Health and Welfare.

ply.²³⁴ Caregivers are by law required to provide high quality care, which includes ensuring access to necessary medicinal products. However, no regulation demands that pharmacies or actors in the supply chain ensure supply during crises. Thus, for example, pharmacies do not have to stock medicinal products or otherwise guarantee that they can provide pharmaceuticals during disruptions, such as problems in IT services or during electricity shortages.²³⁵

Cooperation

The EU has a regulatory system on pharmaceuticals, in which Norway also participates.²³⁶ While much of EU regulation focuses on pharmaceutical safety, tackling disruptions in the supply of pharmaceuticals is a rising theme for collaboration.²³⁷ The European Medicines Agency (EMA) works with other European regulatory agencies to minimise the consequences of shortages of medicinal products.²³⁸

On a regional level, the Nordic Public Health Preparedness Agreement, established by the Nordic Group for Public Health Preparedness, or Svalbardgruppen, is an agreement between the five Nordic countries and their autonomous regions for preparing and developing health and medical care preparedness. The cooperation covers contingency measures and assistance if a signatory country faces an emergency or disaster.²³⁹ Denmark, Finland, Iceland and Norway also operate a cooperative scheme regarding vaccine preparedness.²⁴⁰ Sweden participates in the group only as an observer, as it does not have a national agency responsible for security of supply of medicinal products.²⁴¹ Furthermore, Denmark, Norway and Iceland share their markets

234 Leth, Eva, Åsa Ek and Karin Lundgren Kownacki (2019), 52–53, 56; Swedish National Audit Office (2018), 6, 47.

235 Swedish National Audit Office (2018), 51–53; Leth, Eva, Åsa Ek and Karin Lundgren Kownacki (2019), 43.

236 Interview with Hdir.

237 Bochenek et al (2018): 'Systemic measures and legislative and organisational frameworks aimed at preventing or mitigating drug shortages in 28 European and Western Asian countries' in *Frontiers in Pharmacology*.

238 Heads of Medicines Agency and European Medicines Agency (2015): Work programme of the HMA/EMA task force on availability of authorised medicines for human and veterinary use.

239 Nordhels (2002): Nordic Public Health Preparedness Agreement.

240 Leth, Eva & Åsa Ek and Karin Lundgren Kownacki (2019), 148.

241 Interview at the National Board of Health and Welfare.

with each other, and participate in a Nordic forum to share knowledge and experiences in this regard.²⁴² Norway and Denmark have a formal agreement to cooperate on pricing and producing bids and offers for pharmaceutical products.²⁴³

To provide an indicative assessment, medicine shortages have been recognised as a topical problem in each country. In interviews, Finnish private and public actors were united in assessing the situation as being likely to deteriorate in the future.²⁴⁴ In Norway, the exploration concluded that there is a desire to create a more powerful market position in the global pharmaceutical sector. In Sweden, the rising frequency of disruptions in the globalised production has been identified as one of the drivers to reforms in the current national preparedness measures on pharmaceuticals.²⁴⁵ For each party, the scale of the issue is relatively new. An interviewee stated that common crisis preparedness exercises often omit the aspect of medical products, simply assuming that there will be enough drugs and devices available to provide effective healthcare in disasters.²⁴⁶

The problem remains multi-faceted, and effective national and international measures are not evident. As a large market area with regulatory powers, the EU can wield influence over the requirements set for global production processes in a way that the Nordic countries, separately or together, cannot. At the same time, the Nordic countries' deep ties and similar medicinal needs could be used to explore regional, tailored solutions. Furthermore, the national level is not to be eschewed: some countries and institutions are considering domestic measures to mitigate the supply risk. In Norway, for instance, discussions of improving production at home have emerged.²⁴⁷

242 Interview with Hdir.

243 Danish Ministry of Health and Norwegian Ministry of Health and Care Services (2018): Intensjonsavtale mellom Danmark og Norge: Med ønske om felles forhandlinger om pris på utvalgte legemidler.

244 e.g. interview at a pharmaceutical distributor, Finland, 16 August; interview at a pharmaceutical distributor, Finland, 17 September.

245 Leth, Eva, Åsa Ek and Karin Lundgren Kownacki (2019), 9.

246 Interview at the National Board of Health and Welfare, Sweden, 5 September.

247 Interview with Hdir.

An interviewee stated that common crisis preparedness exercises often omit the aspect of medical products, simply assuming that there will be enough drugs and devices available to provide effective healthcare in disasters.

Discussion

Several provisional measures were compiled during the research process. An overarching form of international collaboration could be for Finland, Norway and Sweden **to push the supply issues in pharmaceuticals further on the EU/EEA agenda**. A European approach may give rise to regulatory and market-based measures that no Nordic country can realise on its own. While the increase in shortages is being recognised to a growing degree, there is a need to strengthen a common understanding of the issue. For instance, the characteristics of the EU Member States' domestic markets and regulation may expose some countries to disruptions more than others.²⁴⁸ Detailed information on the medicines in the market throughout the EU remains patchy, and more systematised data would help identify the roots of drug shortages.²⁴⁹

Trilateral and regional collaboration to ensure the supply of pharmaceuticals in the Nordic region can, to an extent, complement European measures. For instance, France has called for a European approach to deal with the supply issues, which involves attracting drugs production back to France and Europe, and suggested that the EU could set up pub-

lic drug factories.²⁵⁰ In the United States, bottom-up approaches involving hospitals, health care systems and philanthropists are seeking more secure supply chains with the manufacturers.²⁵¹ The prospects for adopting these or other measures in the Nordic region require their own investigation. An example of a joint action could be **to explore together the countries' means to acquire and produce essential medicine together in major crises**.²⁵² The study could involve exploring the convertibility of the current production facilities in the three countries to produce crisis-specific pharmaceuticals, such as antibiotics, demand for which is prone to increasing during wartime and other crises. The countries could also map the shared inflows of vital pharmaceutical products, or to start by comparing individually conducted vulnerability analyses, in order to establish a shared understanding of their common dependencies.

Another measure could be **to support common pharmaceutical markets**, as current order volumes might be too small to persuade global manufacturers

to prioritise the region in times of scarcity. Agreements between some Nordic countries provide one pathway that can be developed on a wider basis.²⁵³ However, they would not necessarily mitigate shortages, as even together, the Nordic states are small buyers competing against globally rising demand. A linked action could be **to remove some regulatory obstacles in distributing medicine during major shortages across the three countries**. National legislations, for instance on prescription and packaging labels, could be better aligned with cross-border preparedness collaboration.²⁵⁴ Already in normal circumstances, the three countries' high level of digitalisation may allow for new innovations, such as adopting QR codes, to provide more information on pharmaceuticals.²⁵⁵ The national authorities and companies could explore such new technologies to reduce intra-Nordic friction, while maintaining high standards to keep counterfeit medicines out of the domestic markets.

Finally, a suggestion, already discussed in a report

commissioned by the Nordic Council of Ministers, is **to set up a common Nordic pharmacy for rare medicine, which could involve a Nordic preparedness storage facility for critical medicinal products and devices**.²⁵⁶ Currently, only Finland has a national, public-private scheme for storing critical medicine, which is intended to 'buy time' for the country to locate alternative sources when there is a sudden change in the supply or demand of a medicine. A shared storage facility, either of active ingredients or ready-to-use medicines, would distribute the costs of maintaining the medicinal reserves among the participating countries, while providing a limited cushion against global shortages. Potential hurdles involve agreeing on its location, terms of use and the running expenses involved. Furthermore, as per interviews it is likely that the private sector is not eager to commit to creating new storage facilities. Again, there are lighter measures available. To enhance collaboration, the countries could cooperate **to create a shared, real-time inventory of rare medicine that their hospitals and other medical centres have in their inventories**.²⁵⁷

248 Interview at a pharmaceutical distributor, Finland, 17 September.

249 European Medicines Agency (2020): Availability of medicines.

250 French Ministry of Solidarity and Health (2019): Lutter contre les pénuries et améliorer la disponibilité des médicaments en France: Feuille de route 2019–2022.

251 Civica Rx (2019): Quality. Supply. Price. How Civica Rx aims to solve the US hospital drug shortage crisis.

252 Interview at the NESAs, Finland, 7 May.

253 Danish Ministry of Health and Norwegian Ministry of Health and Care Services (2018).

254 Cf. Heads of Medicines Agency/European Medicines Agency (2015), 2.

255 European Medicines Agency (2018): Mobile scanning and other technologies in the labelling and package leaflet of centrally authorised medicinal products.

256 Interview at the National Board of Health and Welfare; Könberg, Bo (2014): Det framtida nordiska hälsosamarbetet.

257 Interview at the NESAs, Finland, 7 May.

7 Transport

Countries

FINLAND

The artery of the Finnish transport system is the Baltic Sea: ship transport comprises around 90 per cent of the country's export cargo flows and around 80 per cent of import cargo flows in metric tonnes.²⁵⁸ Vital cargo routes to Finland connect Finnish ports with Sweden, Germany and Estonia. Truck traffic is gaining in importance as cargo volumes increase on Via Baltica, a southern land route, in which trucks are loaded onto vessels when they cross the Gulf of Finland between Tallinn and Helsinki. Faster and more frequent land and ferry connections have

turned the route into a commercially viable alternative to a longer Baltic Sea route.²⁵⁹ Sea cargo travels from and to Finland as bulk, in modular sea containers and on trucks and trailers loaded on and off vessels. A significant import by sea is oil: almost all crude oil refined in Finland is brought in from the Russian oil ports on the Gulf of Finland, whereas refined oil products are shipped from other destinations, such as from St1's refinery in Gothenburg, Sweden.²⁶⁰

²⁵⁸ Finnish Customs (2019): International trade 2018: Finnish trade in figures, 30–31;

²⁵⁹ Hakala, Emma et al (2019c): Suomen huoltovarmuus ja Baltian alue: Tiivistävät yhteydet muuttuvassa turvallisuusympäristössä.
²⁶⁰ Finnish Customs (2019), 32; Rautiainen, Pekka and Irmeli Rinta-Keturi (2011): LOGHU3: Toimintaympäristön kehittyminen, 10.

OVERVIEW

Transport encompasses all the activities necessary to move goods or people from one geographical position to another, including the infrastructure and distribution networks as well as their operators in five transport modes: air, road, rail, maritime and inland waterways.²⁶¹ Without trying to exhaust the vast field, this section explores some of the challenges Finland, Norway and Sweden face in securing the physical flow of goods, such as food and medicine, and the measures they have taken to resolve them.

Finland, Norway and Sweden are small economies deeply integrated with global trade, whereby in each of them many socially

critical functions are dependent on stable inflows of raw materials, production inputs and other items. Geography matters. Finland is strongly dependent on the Baltic Sea as a vital channel for cross-border cargo flows. Sweden is also reliant on the Baltic Sea, although it has better access to key logistical routes to continental Europe and the North Sea. Norway stands somewhat apart from its two neighbours due to its coast-length access to the Atlantic, as well as overlapping infrastructures and capabilities built to ease logistics in the mountainous country.

Transportation in each country is affected by similar trends, although to different degrees. The internationalisation of the owners,

operators and services in key logistics is a factor in preparedness efforts.²⁶² Foreign shareholders and staff can help streamline processes and secure companies with means to make it through hard times. However, their commercial interests might not automatically align with the countries' national transport needs in exceptional times. Furthermore, the shift towards electrification and away from fossil fuels in the transport sector calls for a reconsideration of current security of supply measures and planning.²⁶³ Finland, Norway and Sweden differ in some of their starting points, but areas for potential cooperation do emerge.

²⁶¹ European Commission (2020a): Transport modes.

²⁶² OECD (2019f): Acquisition- and ownership-related policies to safeguard essential security interests: Current and emerging trends.

²⁶³ European Commission (2020b): Clean transport, urban transport: Alternative fuels for sustainable mobility in Europe.

Sea cargo is complemented by transportation on land. The road network is the primary platform for cross-border cargo flows on land between Finland, Norway and Sweden. The rail connections remain less developed: the Finnish track gauge differs from that of its western neighbours, there is only one, unelectrified rail line to Sweden through Tornio, and no passenger rail traffic operates across the western borders. Theoretically, were the access both to the Gulf of Finland and the Gulf of Bothnia limited, land transport through northern Sweden and Norway could provide Finland with access to the Norwegian Sea or through the Danish Strait to continental Europe.²⁶⁴ However, few commercial actors have had an incentive to develop the land route as long as crossing the Baltic Sea remains a viable alternative. Russia, with several cargo and passenger trains running daily, remains the most important partner in land transports, as Finnish industrial companies import raw materials, such as chemicals and wood, for domestic production.²⁶⁵

Air transport remains a primary channel for long-haul passenger traffic.²⁶⁶ Helsinki-Vantaa Airport is developing into a hub of international transport between Asia and Europe: from 2017 to 2018, the number of passengers grew by 10 per cent to 20.8 million.²⁶⁷ There are also daily flights between Helsinki and Finland's other cities, which help connect the wide but sparsely populated country. The airport area is of national importance not only because of the airport: several logistical centres and terminals are located in its vicinity, making it an important logistical hub for transports even when airplanes are not used in the delivery chain.²⁶⁸

The major public organisations with a responsibility to advance national preparedness efforts in transport are the Ministry of Transport and Communications, The Finnish Transport and Communications Agency Traficom, the Finnish Transport Infrastructure Agency, and the NESAs. The agencies attempt to identify diverse sectoral risks, including blockages in Baltic Sea traffic due to ice, challenges

264 Aaltola et al (2016), 138; Finnish Ministry of the Interior (2019), 50–52.

265 Finnish Customs (2019), 33.

266 NESAs (2013): Suomen sisäiset lentokuljetukset ja niiden merkitys huoltovarmuudelle.

267 Finavia (2019): A record-breaking year in 2018 – Helsinki hit the 20 million mark and passenger volumes at Finavia's airports increased by 10 per cent.

268 NESAs (2011): LOGHU3: Johdon yhteenveto, 9.

in major European ports, stand-stills in air supply routes caused by natural hazards, or restrictions in using neighbouring countries' air space for international flights.²⁶⁹ Cyber-attacks have been a growing concern for supply chain management systems, as faced by, among others, the logistics companies Maersk and TNT Express, in June 2017.²⁷⁰

The public risk mitigation measures taken are as wide-ranging as the risks themselves. In sea transport, arrangements are in place with major cargo and passenger operators, such as Viking Line, Tallink Silja, Finnlines and Eckerö Line, to ensure that sufficient national capacities exist to operate the vital Baltic Sea routes. Some tanker capacity is in state ownership to ensure that shipments continue in both normal and emergency circumstances. In road transport, the authorities monitor the availability of vehicles, such as special-purpose trucks used to carry chemicals, gasses and fuels, in the country to ensure the means for vital inland deliveries. In both rail and air transport, state ownership in key companies, such as Finnair, the national air company, and VR Group, the national rail company, remains partly to ensure that logistics remain operational under exceptional circumstances.

Of the many trends affecting the cargo flows between Finland and the rest of the world, this overview highlights the increased proportion of foreign ownership, personnel and services in logistics vital to the country. Since the early 2000s, several major container terminal operators in Finland have been acquired by foreign owners.²⁷¹ Multinational companies can provide their Finnish subsidiaries with the financial backing needed to continue operations through global economic downturns and other hard times.²⁷² However, foreign owners might not treat logistical infrastructure considered nationally vital as worth maintaining if business incentives to do so are absent, and foreign staff might not be willing to sail on routes important to Finland amidst a tense geopolitical situation. Accordingly, Finnish preparedness planning aims to accommodate the growing importance of multi-national logistics operators, such as Schenker and DHL, in its own efforts.²⁷³

269 Finnish Ministry of the Interior (2019): National risk assessment 2018, 50–52.

270 Wired (2018): The untold story of Notpetya, the most devastating cyberattack in history.

271 HVK (2011): LOGHU3: Johdon yhteenveto, 8–9.

272 Interview at a shipping company, Finland, 29 August.

273 Rautiainen, Pekka and Irmeli Rinta-Keturi (2011): LOGHU3: Toimintaympäristön kehittyminen, 8–10.

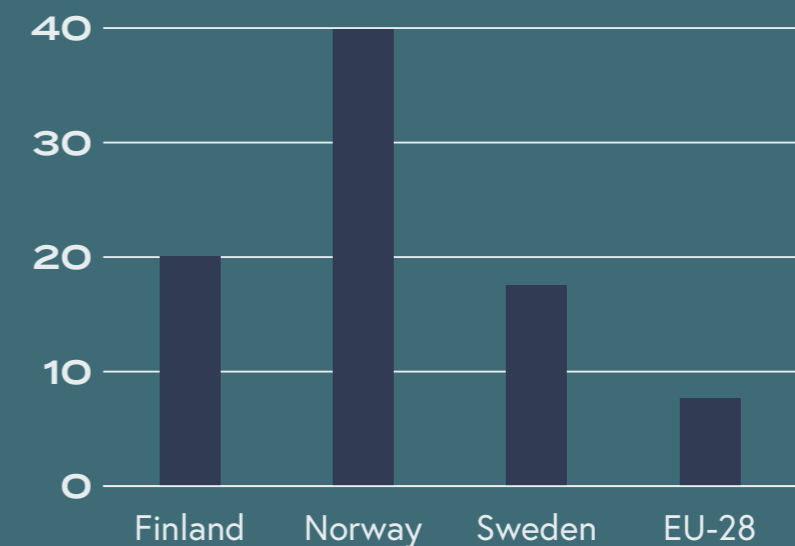


Figure 11: Gross weight of seaborne freight handled in all ports, in tonnes per inhabitant, 2017

Source: Eurostat 2019b

NORWAY

Norway's transportation is in large part shaped by its particular geography. Mountainous and thin, the country boasts a coastline among the longest in the world. Traditionally, this has meant that sea-transportation has been important throughout Norwegian history, especially for longer journeys. Sea transportation is still a major Norwegian asset (figure 11), and as of 2017, Norway had the ninth largest dead-weight tonnage of beneficial ship owning countries in the world, which makes for a sizeable merchant marine fleet.²⁷⁴ In addition to this, road routes are often connected by passenger and car ferries, where crossing a fjord or lake is necessary. In 2018, over 11 million passengers utilised these ferries.²⁷⁵ In terms of domestic goods transport, sea transportation accounted for 80 million tonnes of goods being transported in 2018, just under 20 per cent of all domestic goods transportation.²⁷⁶

Aviation has become an important mode of transport in Norway, as mountainous terrain and long distances between population centres favours transportation types that do not follow difficult topography. Particularly for passenger traffic between the north and the south of the country, air transportation is the dominant mode. However, for shorter distances, too, such as between Stavanger and Oslo, air traffic makes up a significant portion of travellers. The same is true with regards to international tourism.²⁷⁷

Rail transportation also plays a role; there are 4,200 kilometres of public railway tracks and 334 railway stations in Norway.²⁷⁸ However, most infrastructure is centred around the south east of the country, and the terrain makes expanding railways difficult. Some lines do stretch across the country, notably to Stavanger, Bergen, and Åndalsnes in the west and Bodø in the north. Nevertheless, rail transportation only accounted for less than 3 per cent of all domestic goods transport in 2018.

By far the most frequently used mode of transportation is road, with the car accounting for 76 per

cent of all travel in the country. In 2018, around 264 million tonnes of domestic goods transport, or over 63 per cent of all goods transport, was carried out on roads.²⁷⁹ Nevertheless, if the distance covered is added to the equation, in tonne-kilometers, road transportation, shipping and pipeline transportation accounted for equal portions of total transportation.²⁸⁰ This would suggest that road transportation is of a more local character than regional shipping and pipeline transportation modes.

At governmental level, the Ministry of Transport (SD) is in charge of the transport sector, covering all transportation modes. A series of subordinate authorities supplement the Ministry. A mass of private firms and enterprises are also active in this sector, such as transportation and logistics firms, infrastructure builders and maintainers, and passenger services. A general rule of thumb is that the responsibility for most of the infrastructure underpinning the transport sector rests with the state or public authorities, while the responsibility for most of the transportation services using this infrastructure is in private hands.²⁸¹

In terms of infrastructure, the road network and the sea-routes in particular offer rerouting options to bypass blocked access. Road and sea transport is characterised by being serviceable by a series of private actors, and will be resistant to exhaustion in this way. Air transport is similarly operated by several private enterprises, but the challenge here is that the airport infrastructure offers little in the way of redundancies, since individual airports service relatively large regions by themselves and are difficult to replace. Rail transport suffers in that railway lines are fixed and, in many cases, converge in single axes, as well as there being few service providers available. Rail transport is therefore perhaps the least redundancy-capable of the transport modes.²⁸²

Nonetheless, all modes contain at least a significant level of redundancy, and crucially, there is a significant degree of redundancy *between* the modes. One method of transport can in many cases be replaced by another in the event of a crisis.²⁸³ For example, goods or passengers needing to go from A

to B can be transported by sea to the most optimal port, and then traverse the country by rail, air or road, (or any combination thereof) avoiding limits within individual modes of transport. The supply of transport services can thus be described as quite robust. However, transport is highly dependent on other sectors: fuels and electricity are vital, as are control and logistics systems, satellite services, financial services and telecommunications. In turn, getting fuels, food, and other critical supplies to where they are needed requires a functioning transport system. Hence, the dependencies are in many cases mutual.

Perhaps one of the most striking trends in the sector is the move towards electrification and green technologies. This is true across the board of transport modes. Paired with increasing advances in digital technology, the sector looks poised to change rapidly in the near-to-mid future. This climate change awareness work affects the entire sector: Norway is committed to the Paris Climate Agreement and aims to, along with Iceland and the EU, cut the carbon emissions of its transport sector by 40 per cent by 2030.²⁸⁴

SWEDEN

In Sweden, road traffic is operated by several large, often internationally owned transport companies, such as DB Schenker and DHL, which contract smaller transport companies as subcontractors.²⁸⁵ The smaller companies are important in the regional markets as well as in specialised transport solutions, such as those involving fuels, oils, and food products. Most goods terminals are managed by international operators, or by major companies in specific subsectors with their own distribution terminals, such as the food retailer ICA gruppen AB.

The rail transport sector is deregulated, with several domestic and international operators running long-distance and regional transportation of passengers and goods. Only five per cent of the passenger transport on rails is done to or from another country.²⁸⁶ Reflected against the volumes of goods

transported to or from other countries, rail traffic is more international than road traffic (figure 12), as the Swedish railway is directly connected to Norway and Denmark, as well as to Germany through train ferries.

Ports serve as important transport hubs. They are often owned by the municipalities, but in several cases are operated by private companies.²⁸⁷ Ferries are an important subsector of sea traffic. Besides vital domestic connections, such as the route connecting the island of Gotland to the mainland, Swedish and Nordic companies operate several connections to other countries. Around 28.2 million of the 30 million passengers travelling through Swedish harbours travelled to or from other Nordic countries, especially Denmark or Finland.²⁸⁸

Passenger traffic is the dominant form of traffic in air transport. Out of the 248 airports in the country, the bulk of commercial air traffic is operated from the 47 airports certified for regular and charter traffic. The Swedish state owns ten of these through the company Swedavia, whilst the rest are owned by the regions, municipalities or privately. Airports close to major cities, Stockholm Arlanda being by far the largest of them, capture most traffic flows, and Denmark, Norway and Finland are among the six most important destinations.²⁸⁹ Several airlines provide domestic connections for passengers. SAS AB remains an important Nordic actor in air traffic: its two largest shareholders are the Swedish and Danish states, whereas Norway divested its shares in 2018.²⁹⁰

No single public actor has total responsibility for preparedness efforts in the transport sector, but four public agencies have affiliated obligations: the Swedish Transport Administration (Trafikverket), the Swedish Transport Agency (Transportstyrelsen), the Swedish Maritime Administration (Sjöfartsverket), and Air Navigation Services of Sweden (Luftfartsverket). The first of the four agencies is responsible for coordinating total defence planning in cooperation

274 International Chamber of Shipping (2018): Largest Beneficial Ownership Countries.

275 Statistics Norway (2019a): Kollektivtransport.

276 Statistics Norway (2019b): Bil og transport; Statistics Norway (2019c): 11403: Innenlandsk godstransport, etter statistikkvariabel og år.

277 Avinor (2019): Avinor og norsk luftfart 2019.

278 Bane NOR (2019): Jernbanen i tall.

279 Statistics Norway (2019b); Statistics Norway (2019c).

280 Statistics Norway (2017): Godset likt fordelt mellom båt, bil og røyrledning.

281 DSB (2018b): Samfunnets kritiske funksjoner.

282 *ibid.*

283 *ibid.*

284 Energy Norway (2019): Norge binder sitt klimamål til EU.

285 Swedish Association for Road Transport Companies (2016): Fakta om åkerinæringen.

286 *ibid.*

286 Transport Analysis (2019): Bantrafik 2018.

287 For instance, the container-port in Gothenburg is owned by the Göteborgs Hamn AB, a company owned by the municipality, but operated by the Danish and Maersk-owned APM terminals. In Stockholm the container-port Frihamnen is owned by the company Stockholms Hamnar, owned by the municipality, but operated by Hutchinson Ports, a company based in Hong Kong.

288 Transport Analysis (2019): Sjötrafik 2018.

289 Approximately 57 per cent of the total number of passengers in air traffic in Sweden during the year 2018 were passing through Arlanda. Transport Analysis (2019): Luftfart 2018.

290 Solsvik, Terje (2018): Norway sells remainder stake in SAS airline! Reuters. 27 June.

A paradigm example of a cross-sectoral dependency is on energy: about 75 per cent of the energy used in the transport sector comes from fossil fuels.

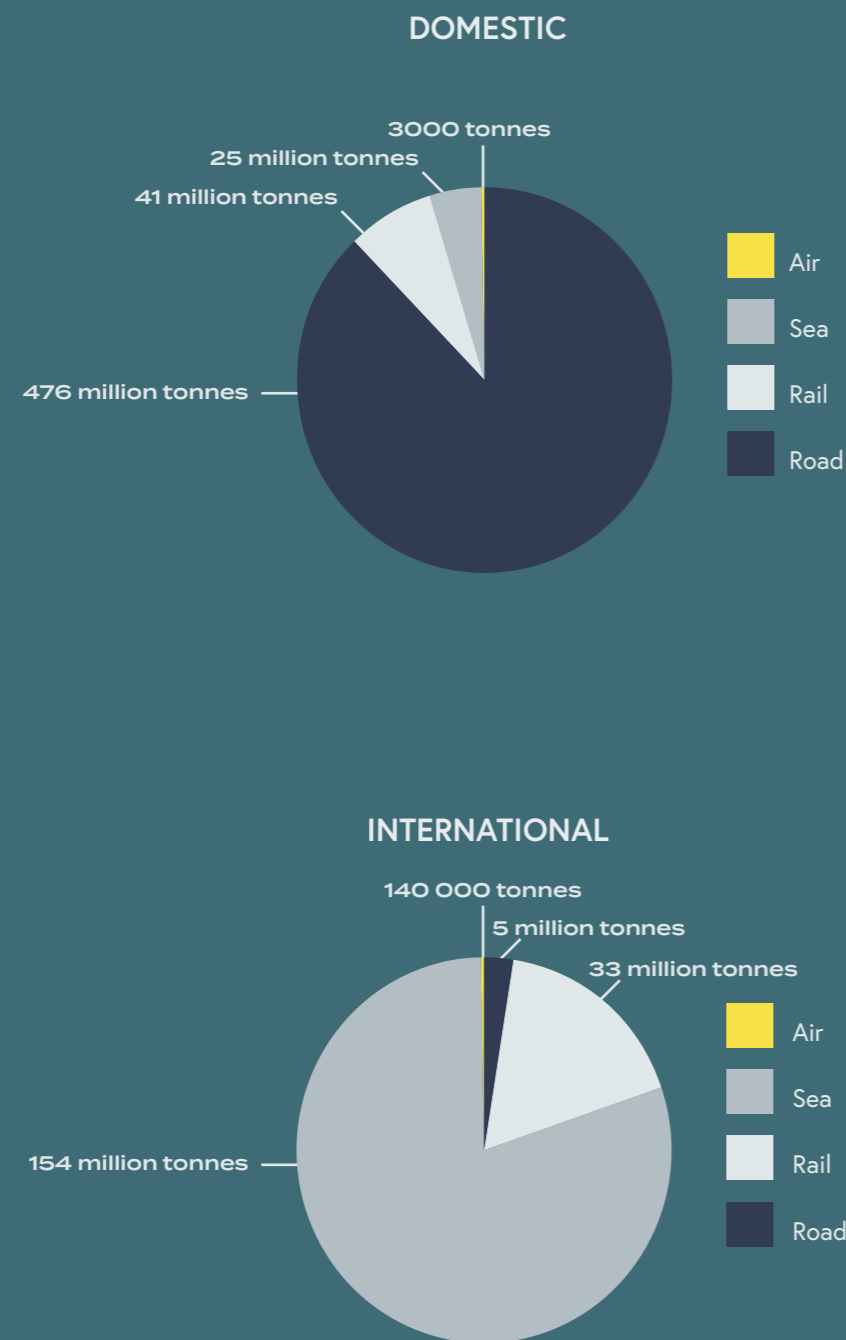


Figure 12: Swedish goods transport, 2018

Source: Transport Analysis 2019a–d

with other actors and public agencies within the sector, and for those operators and infrastructure not falling under any other agency's responsibility.²⁹¹

Today, the transport sector is dominated by few but large companies.²⁹² To involve them, some of the preparedness work in the Swedish transport sector is coordinated by TP SAMS, a voluntary forum for cooperation between private actors and public agencies within the area of transport and societal disturbances.²⁹³ The Swedish Confederation of Transport Enterprises, which aims to represent the entire transport sector by serving as an umbrella organisation for associations and companies in the Swedish transportation sector, is an active member of the forum.²⁹⁴

Already in ordinary circumstances the transport sector is subject to various disturbances. Some, relatively conventional threats are posed by climate-related events like snow storms, strong winds, high temperatures or flooding.²⁹⁵ Others are more cross-sectoral, such as those linked with telecommunications or financial infrastructure. A paradigm example of a cross-sectoral dependency is on energy: about 75 per cent of the energy used in the transport sector comes from fossil fuels.²⁹⁶ These fuels are imported to Sweden from the global markets; crude oil, for instance, primarily originates from the North

Sea and Russia.²⁹⁷ Disturbances in transport connections may also be caused by component failures, shortages of electricity or breakdowns in telecommunications. Many of these factors have an international dimension, for instance through outsourced operations or a foreign provider.

Cooperation

Not all preparedness arrangements in the transport sector can be captured in this overview. The Nordic and Baltic countries, as well as the varying affiliations through the EU and NATO, constitute a multi-layered collection of arrangements through which Finland, Norway and Sweden strive to ensure the stability of vital cargo flows.

Norway's efforts are intertwined with NATO's framework, as ensuring a resilient transport function is one of the Seven Baseline Requirements for Civil Preparedness developed by the military alliance.²⁹⁸ Through their partnership status, Finland and Sweden have also engaged on logistical issues in the Nordic region with the military alliance. The EU touches on the preparedness dimension in the transport sector in some arrangements. For instance, the Single European Sky (SES) initiative is a European Commission project with the aim of reforming air traffic management across Europe to respond to challenges in future capacity, safety and environmental demands. The initiative arranges the European airspace into international blocks, with the

291 Swedish Ministry of Enterprise and Innovation (2019): Trafikverket ska samordna krisberedskapen och det civila försvaret inom transportområdet.

292 Interview at the Swedish International Freight Association, Sweden, 3 November.

293 Interview at TP SAMS, Sweden, 8 October.

294 Interview at the Swedish Transport Administration, Sweden, 3 September.

295 *ibid.*

296 Swedish Energy Agency (2019b): Energiindikatorer 2019 – Uppföljning av Sveriges Energipolitiska mål.

297 Swedish Energy Agency (2015): Risk- och sårbarhetsanalys över energiförsörjningen i Sverige år 2015.

298 Roepke, Wolf-Diether and Hasit Thankey (2019): Resilience: The First Line of Defence. *The Three Swords Magazine*, 34.

current construction pointing to Estonia, Finland, Latvia and Norway sharing one block, and Denmark and Sweden constituting a block of their own.²⁹⁹

Cooperation between the Nordic countries is sometimes routine, for instance in planning road or rail work close to or at the borders, whereas ambitions for more strategic cooperation on emergency and security of supply planning ebbed and flowed in the 2010s. The national authorities of the Nordic countries held collective meetings on the theme in 2014 and 2017, but the meetings have not continued. Current cooperative arrangements revolve around specific themes, sea traffic on the Baltic Sea being a case in point: agreements between the countries on the use of icebreakers in wintertime are in place, and the Nordic authorities cooperate on the potential evacuation of ferries.³⁰⁰ Furthermore, the countries have developed bilateral arrangements. For instance, in 2017 the Swedish Transport Administration and the Finnish Traficom presented a Memorandum of Understanding with the aim of creating a more solid base for collaboration.³⁰¹ The parties have been meeting on a regular basis, performing table-top workshops to prepare for different kinds of scenarios and crises.

To provide a brief analysis, the three countries' priorities in securing their cross-border cargo flows are not fully aligned, but there is potential to expand the ongoing collaboration between Finland and Sweden to involve further countries. The challenge remains that any trilateral, Nordic or even Nordic/Baltic framework to secure cross-border cargo flows has to accommodate the countries' various starting points in a way that ensures all parties retain an interest in maintaining the collaboration as a whole. For instance, whereas Norway's rugged terrain poses a challenge to intra-country logistics, the country retains coast-wide access to the Atlantic and a strong commercial fleet, and its overlapping networks of road, rail, sea and air transport leave primarily the remote northern regions exposed to a heightened risk of disruptions in logistical flows. Accordingly, Norway's international cooperation on security of supply planning mostly takes place under the auspices of NATO, and its arrangements with Finland

and Sweden tend to serve individual needs, such as to improving logistics in the Finnmark and Tromsø region by drawing on the neighbouring countries' road networks.

To compare, Finnish and Swedish cargo flows are more tied to the Baltic Sea. Finland retains a steady interest in ensuring that the Baltic Sea, its artery of cargo flows, remains open for traffic, as does Sweden, although its location closer to continental Europe and the Atlantic gives the country more alternative channels for cargo than those of its eastern neighbour. However, in response to the changing geopolitical context Sweden is readjusting its priorities, which has contributed to the country's growing interest in collaborating on Baltic Sea logistics, for instance through bilateral arrangements with Finland. If further collaboration is to take place, these and other characteristics have to be addressed to make joint arrangements beneficial to all parties.

299 European Commission (2020c): Functional airspace blocks (FABs).

300 Interview at the Swedish Transport Administration, Sweden, 3 September.

301 Interview at TP SAMS.

Discussion

This section presents some collaborative measures that were compiled by during the project. One suggestion is **to expand the ongoing Finnish-Swedish cooperation by inviting Norway, as well as Denmark, to resume collaboration on maintaining vital transport flows in the Nordic region.**³⁰² From Finnish and Swedish perspectives, Norway joining the arrangements would allow for further scoping of the feasibility of northern land routes in a hypothetical situation in which the cargo routes through the Baltic Sea are unavailable. Were the Gulf of Finland and the Gulf of Bothnia blocked, a northern cargo route to the Norwegian Sea could provide a contingency channel, although limited in capacity and currently commercially undeveloped.³⁰³ While the route is not sufficient for cargo volumes equivalent to those currently shipped over the Baltic Sea, further information on its usability would benefit the countries' national emergency planning. As pointed out by a Swedish interviewee, a precondition for expanding collaboration in this way is the buy-in of the private sector. It would be beneficial if measures taken were perceived by all parties as useful in normal circumstances as well as in crises.³⁰⁴ The same call for private sector purchase applies to all three countries: companies are likely to participate more actively in such cooperation that, besides promoting national preparedness, helps them improve their own continuity management strategies.

From a Norwegian perspective, the immediate benefits of further Nordic cooperation in securing cargo flows are less tangible. However, trilateral or wider cooperation could include measures **to identify and mitigate potential dependencies that arise from transiting to new transporting technologies.** Innovations in freight transport, such as e-commerce, 3D printing, autonomous trucks and high capacity vehicles, are likely to affect the heavily digitalised transport sector across the Nordics.³⁰⁵ In a similar vein, if the phasing out of fossil fuels con-

tinues, Finland, Norway and Sweden could find it useful **to scope their access to and their capacity to produce the biofuels and electricity needed in transportation.** Such an investigation might uncover new areas in which the countries could rely on each other. Finally, the research process indicated that at least in Finland and Sweden the logistical sector is increasingly owned and operated by foreign entities. The countries could conduct an initial investigation **to assess the mutual availability of tank trucks, cargo containers and other transport infrastructure in different kinds of emergencies.** Building a common understanding of the key operators' commitments in the three countries, as well as comparing steps taken in each with regard to the international ownership of key transportation infrastructure, could help reinforce the interlinked system of cargo flows in the region.

302 Interview at the Swedish Transport Administration, Sweden, 3 September; interview at TP SAMS.

303 Interview at the NESAs, Finland, 23 October.

304 Interview at the Swedish Transport Administration.

305 OECD (2019g): 'Disruptions in freight transport' in OECD (2019): ITF Transport Outlook 2019.

8

Conclusion

By engaging with perspectives across the public and private sectors in Finland, Norway and Sweden, this report has compiled a total of 28 provisional themes for further collaboration on security of supply and critical infrastructure protection. This endeavour has not exhausted the measures that could be taken. More detailed follow-up studies are in demand, as the need to better understand cross-border flows and cross-sectoral dependencies vital to contemporary Nordic societies is only likely to be accentuated. Furthermore, the measures compiled are provisional and intended to be examined by policy-makers and experts. This conclusive chapter suggests that a cross-sectoral take is useful in developing the next steps for collaboration, and outlines three complementary approaches for making new associations.

One approach is to seek for common interests in and across the six sectors explored. This report argues that Finland, Norway and Sweden share many challenges, because they are forerunners in the process of digitalisation, and constitute small economies exposed to disruptions in the global supply of pharmaceuticals. In the energy and transport sectors, the countries' starting points are partially aligned: their preparedness efforts are likely to be affected by the energy transition, and they share

some, if not all challenges related to vital cargo flows in the future. Likewise, while the countries' payment systems run on differing infrastructures, areas for collaboration may emerge as the private sector pursues new cross-border initiatives and the societies become increasingly cashless. Finally, the countries' largely independent national measures to ensure food security may benefit from the sharing of best practices and formalising some of the existing collaboration. In and across these six sectors, Finland, Norway and Sweden can combine different measures to help overcome their diverging priorities if such arise.

A second approach is to bring together similar types of measures. Some suggestions considered in this report are about strengthening the shared informational base. Comparing the three countries' relative import dependencies in the food sector, exploring their shared capacity to acquire essential medicines, and working together to identify cross-sectoral dependencies between the energy sector and other sectors, such as on transport fuels, illustrate areas for joint analysis. Other suggestions involve changes to the existing platforms. These include harnessing old fora to tackle new themes, such as the role of NordBER in the energy transition;

encouraging thematic, cross-border set-ups that pool expertise and share information, such as the Nordic Financial CERT in the financial sector; and creating new arrangements, for instance through common pharmaceutical storage facilities or shared inventories. A third group involves harmonising regulatory requirements across the three countries to facilitate better cooperation during disruptions in flows of good, products and services. They are well illustrated by the suggestions to refine the regulation concerning the flows of pharmaceuticals and food products between the three countries during major shortages. And a fourth group includes measures to enhance cross-border policy coherence, as captured by the suggestion to synchronise the countries' national climate policies to accommodate energy security, or the call to smoothen the pooling of Nordic digital expertise by aligning the ways the national authorities strike deals with key IT providers.

A third approach is to realign the level of international collaboration at which specific issues are addressed. Some suggestions in this report can be advanced by expanding currently bilateral dealings. The Finnish-Swedish cooperation on preparedness in transportation, and the first steps the two countries have taken to address cyber security, can constitute such areas. Some of the measures in this report could be used in updating on a bilateral or trilateral basis the countries' relatively dated bilateral agreements on economic co-operation during crises. In other cases, collaboration might involve working together on wider fora, as the five Nordic countries, as the Nordic/Baltic region, or in the EU and the NATO, with which Finland, Norway and Sweden remain differently affiliated. Problems in the global supply of pharmaceuticals, for instance, are rooted in global supply chains that the three countries have few direct means to manage, although they can try to cushion themselves against shortages through national and international measures. Finland, Norway and Sweden could benefit from a dialogue aimed at differentiating those themes that are best pursued as a trio from those challenges that are to be primarily tackled at other levels of collaboration.

Finally, the thematic areas of security of supply and critical infrastructure protection set special requirements for any joint arrangements. This research project engaged both with private and public sector experts to reflect that the buy-in of the companies,

whose operations underlie many critical societal functions, as well as of other societal stakeholders, is a central component in realising the comprehensive security and total defence approaches in the three countries. Involving key actors and organisations to shaping the national approaches strengthens the coherence and durability of the arrangements built together. Throughout, this report has attempted to serve those domestic discussions on the best way forward. If the right combinations are found, trilateral cooperation can serve as a valid tool for Finland, Norway and Sweden to address the challenges associated with cross-border flows and dependencies.



Sources

All online sources accessed in January 2020.
Digital version includes hyperlinks where possible.

- [Aaltola, Mika, Juha Käpylä, Harri Mikkola, Timo Behr \(2014\): Towards the geopolitics of flows. Finnish Institute of International Affairs.](#)
- [Aaltola, Mika, Christian Fjäder, Eeva Innola, Juha Käpylä and Harri Mikkola \(2016\): Huoltovarmuus muutoksessa. Finnish Institute of International Affairs.](#)
- [Acosta, Angela, Egda Patricia Vanegas, Joan Rovira, Brian Godman and Tomasz Bochenek \(2019\): 'Medicine shortages: Gaps between countries and global perspectives' in *Frontiers in Pharmacology*.](#)
- [Affärsverket svenska kraftnät \(2014\): Vägledning för krishantering inom elförsörjningen. Svenska kraftnät.](#)
- [Ali-Yrkkö, Jyrki, Juri Mattila, Mika Pajarinen and Timo Seppälä \(2019\): Digibarometri 2019: Digi tulee, mutta riittävätkö resurssit? Helsinki, The Research Institute of the Finnish Economy \(ETLA\).](#)
- [Association of Finnish Pharmacies \(2019\): Annual review 2018.](#)
- [Avinor \(2019\): Avinor og norsk luftfart 2019.](#)
- [Bane NOR \(2019\): Jernbanen i tall.](#)
- [Bank of Finland \(2020\): Payment systems.](#)
- [Bank of Finland \(2019\): Taulukot.](#)
- [BIS \(2020\): Principles for Financial Market Infrastructures \(PFMI\).](#)
- [Bochenek, Thomaz et al \(2018\): 'Systemic measures and legislative and organisational frameworks aimed at preventing or mitigating drug shortages in 28 European and Western Asian countries' in *Frontiers in Pharmacology*.](#)
- [Brattberg, Erik & Daniel Hamilton \(2014\): 'Introduction' in Brattberg, Erik & Daniel Hamilton \(eds.\): *Global Flow Security: A New Security Agenda for the Transatlantic Community in 2030*. Center for Transatlantic Relations, John Hopkins University.](#)
- [Civica Rx \(2019\): Quality. Supply. Price. How Civica Rx aims to solve the US hospital drug shortage crisis.](#)
- [Clemente, Dave \(2013\): *Cyber security and global interdependence: What is critical?* London, Chatham House.](#)
- [Danish Ministry of Health and Norwegian Ministry of Health and Care Services \(2018\): *Intensjonsavtale mellom Danmark og Norge: Med ønske om felles forhandlinger om pris på utvalgte legemidler*.](#)
- [Deloitte \(2019\): *Chasing cashless? The rise of mobile wallets in the Nordics*.](#)
- [Denmark, Finland, Iceland, Norway and Sweden \(2013\): *General Security Agreement of the Mutual Protection and Exchange of Classified Information between Denmark, Finland, Iceland, Norway and Sweden*.](#)
- [DLF \(2019\): *Dagligvarukartan 2019*.](#)
- [Dover, Ann-Sofie Stenérus, Anders Odell, Per Larsson and Johan Lindgren \(2019\): *Beredskapslagring.. FOI*.](#)
- [Dreyer, Iana and Gerald Stang \(2013\): 'Foresight in governments – practices and trends around the world' in *EUISS: Yearbook for European Security*. Paris, European Union Institute for Security Studies.](#)
- [DSB \(2018a\): *Risikoanalyse av legemiddelmangel*.](#)
- [DSB \(2018b\): *Samfunnets kritiske funksjoner*.](#)
- [DSB \(2017\): *Risiko- og sårbarhetsanalyse av norsk matforsyning*.](#)
- [Economist \(2019\): *A dire scarcity of drugs is worsening, in part, because they are so cheap*. 14 September.](#)
- [Economist Intelligence Unit \(2020\): *The global food security index*.](#)
- [Eriksson, Camilla, Pär Eriksson and Johanna Wahrenberg \(2018\): *Internationella avtal och samarbeten med relevans för civilt försvar*. FOI.](#)
- [Energy Norway \(2019\): *Norge binder sitt klimamål til EU*.](#)
- [Eriksson, Camilla \(2018\): *Livsmedelsproduktion ur ett beredskapsperspektiv: Sårbarheter och lösningar för ökad resiliens*. MSB.](#)
- [Erillisverket Group \(2020\): *Erillisverket Group*.](#)
- [Equinor \(2020\): *What we do*.](#)
- [European Commission \(2020a\): *Transport modes*.](#)
- [European Commission \(2020b\): *Clean transport, urban transport: Alternative fuels for sustainable mobility in Europe*.](#)
- [European Commission \(2020c\): *Functional airspace blocks \(FABs\)*.](#)
- [European Commission \(2019a\): *Evaluation of Council Directive 2008/114 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection*. Commission staff working document.](#)
- [European Commission \(2019b\): *Digital Economy and Society Index*.](#)
- [European Commission \(2019c\): *Digital Economy and Society Index: Country report. Norway*.](#)
- [European Commission \(2019d\): *EU-wide coordinated risk assessment of 5G networks security*.](#)
- [European Commission \(2019e\): *Cybersecurity*.](#)
- [European Commission \(2019f\): *Proposal for a European cybersecurity competence network and centre*.](#)
- [European Commission \(2019g\): *National energy and climate plans \(NECPs\)*.](#)
- [European Commission \(2013\): *Commission staff working document on a new approach to the European Programme for Critical Infrastructure Protection Making European Critical Infrastructure more secure*.](#)
- [European Council \(2008\): *Council Directive 2008/114/EC on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection*.](#)
- [European Central Bank \(2020a\): *Single Euro Payments Area \(SEPA\)*.](#)
- [European Central Bank \(2020b\): *What is TARGET Instant Payment Settlement \(TIPS\)?*](#)
- [European Medicines Agency \(2020\): *Availability of medicines*.](#)
- [European Medicines Agency \(2018\): *Mobile scanning and other technologies in the labelling and package leaflet of centrally authorised medicinal products*.](#)
- [Eurostat \(2019a\): *Shedding light on energy in the EU*.](#)
- [Eurostat \(2019b\): *Maritime port freights and passenger statistics*.](#)
- [Eurostat \(2018a\): *Cloud computing – statistics on use by enterprises*.](#)
- [Eurostat \(2018b\): *Agriculture, forestry and fishery statistics. 2018 edition*.](#)
- [Fimea \(2020\): *Saatavuushäiriöilmoitusten määrä kasvoi vuonna 2019*.](#)
- [Finance Finland \(2019\): *Pankkivuosi 2018*.](#)
- [Finans Norge \(2019\): *Banking sector*.](#)
- [Finavia \(2019\): *A record-breaking year in 2018 – Helsinki hit the 20 million mark and passenger volumes at Finavia's airports increased by 10 per cent*. 11 January.](#)
- [Fingrid \(2018a\): *Reserve power plants*.](#)
- [Fingrid \(2018b\): *Risk of electricity shortage in Finland on Thursday, 19 July*.](#)
- [Finland \(2018\): *Statrådets beslut om målen med försörjningsberedskapen*.](#)

- [Finland \(2008\): Lag om obligatorisk lagring av läkemedel.](#)
- [Finland-Sweden \(1992\): Sopimus Suomen ja Ruotsin välisestä taloudellisesta yhteistyöstä kansainvälisissä kriisitilanteissa.](#)
- [Finnish Chamber of Commerce \(2019\): Yrityksiin kohdistuvat kyberuhat 2019.](#)
- [Finnish Customs \(2019\): International trade 2018: Finnish trade in figures.](#)
- [Finnish Grocery Trade Association \(2018\): The grocery trade market in Finland.](#)
- [Finnish Ministry of Economic Affairs and Employment \(2019\): The act banning the use of coal for energy generation in 2029 to enter into force in early April.](#)
- [Finnish Ministry of Finance \(2018\): Varautumisvelvollisuutta rahoitusallalla koskevan sääntelyn tarkistaminen.](#)
- [Finnish Ministry of the Interior \(2019\): National risk assessment 2018.](#)
- [Fjäder, Christian \(2019\): 'Interdependence as dependence: economic security in the age of global interconnectedness' in Wigell, Mikael, Sören Scholvin and Mika Aaltola \(eds.\): Geo-economics and power politics in the 21st century. New York, Routledge.](#)
- [French Ministry of Solidarity and Health \(2019\): Lutter contre les pénuries et améliorer la disponibilité des médicaments en France: Feuille de route 2019–2022.](#)
- [Gautam, Ajay and Pan, Xiaogang \(2016\): 'The changing model of big pharma: impact of key trends' in Drug Discovery Today, 21\(3\).](#)
- [Gjemdal, Eivind \(2019\): 'Felles evaluering av mulig deltakelse i P27-initiativet avsluttes i Norge'. Bits, 25 March.](#)
- [Glaser, Barney and Anselm Strauss \(1967\): The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago, Aldine Publishing.](#)
- [Hagen, Janne, Ola Hermansen, Øyvind Toftegård, Jon-Martin Pettersen, Roger Steen and Synnøve Lill Paulen \(2017\): Regulering av IKT-sikkerhet: Et helhetlig og fremtidsrettet sikkerhetsregime for forsyningsikkerhet i en digitalisert energisektor. Norwegian Water Resources and Energy Directorate.](#)
- [Hakala, Emma, Ville Lähde, Antti Majava, Tero Toivanen, Tere Vadén, Paavo Järvensivu and Jussi T. Teronen \(2019a\): 'A lot of talk, but little action – the blind spots of Nordic environmental security policy' in Sustainability, 11\(8\).](#)
- [Hakala, Emma, Ville Lähde, Antti Majava, Tero Toivanen, Tere Vadén, Paavo Järvensivu and Jussi T. Teronen \(2019b\): 'Northern warning lights: Ambiguities of environmental security in Finland and Sweden' in Sustainability, 11\(8\).](#)
- [Hakala, Emma, Harri Mikkola, Juha Käpylä, Matti Pesu, Mika Aaltola \(2019c\): Suomen huoltovarmuus ja Baltian alue: Tiivistyvät yhteydet muuttuvassa turvallisuusympäristössä. Finnish Institute of International Affairs.](#)
- [Haugevik, Kristin \(ed.\), Ulf Sverdrup \(ed.\), Björn Fägersten, Karsten Friis, Lars Gjesvik, Pia Hansson, Calle Håkansson, Tuomas Iso-Markku, Hans Mouritzen, Silja Bára Ómarsdóttir, Auður Birna Stefánsdóttir, Øyvind Svendsen \(2019\): Ten years on: Reassessing the Stoltenberg report on Nordic cooperation.](#)
- [Heads of Medicines Agencies and European Medicines Agency \(2015\): Work programme of the HMA/EMA task force on availability of authorised medicines for human and veterinary use.](#)
- [IEA \(2019\): Oil security: The global oil market remains vulnerable to a wide range of risk factors.](#)
- [IEA \(2018\): Energy policies of IEA countries: Finland – Executive summary.](#)
- [International Chamber of Shipping \(2018\): Largest Beneficial Ownership Countries.](#)
- [Kaustell, Kim, Hanna Huitu, Tapani Kivinen, Mikko Laajalahti, Jussi Nikander, Juha Näkkilä, Annu Palmio, Matti Pastell, Antti Suokannas, Eeva-Maria Tuhkanen, Petra Tuunainen, Erkki Vasara \(2017\): Sähköjakeluhäiriöiden vaikutukset elintarviketuotannon jatkuvuuteen. Natural Resources Institute Finland.](#)
- [Keohane, Robert and Joseph Nye \(2012\): Power and interdependence. Boston, Longman.](#)
- [Knuuttila, Marja and Eero Vatanen \(2015\): Elintarvikemarkkinoiden tuontiriippuvuus. Natural Resources Institute Finland.](#)
- [Krisberedskapsmyndigheten \(2007\): Beroende- och konsekvensanalys av livsmedelsförsörjningen. Offentligt arbetsmaterial från KBM:s projekt Samhällskritiska beroenden.](#)
- [Könberg, Bo \(2014\): Det framtida nordiska hälsosamarbetet. Nordic Council of Ministers.](#)
- [Lantmännen \(2019\): Framtidens jordbruk.](#)
- [Lehikoinen, Elina and Matti Kummu \(2017\): Challenges in Nordic food security – A case study of Finland.](#)
- [Leth, Eva, Åsa Ek and Karin Lundgren Kownacki \(2019\): Resursförstärkt läkemedelsförsörjning inför kris, höjd beredskap och krig.](#)
- [Lysne, Olav \(2019\): Olav Lysne på Sikkerhetsfestivalen 2019. YouTube. 10 Dec. 2019.](#)
- [Lääketeollisuus \(2019\): Tilastot.](#)
- [Marttunen, Mika, Jyri Mustajoki, Suvi Sojamo, Lauri Ahopelto and Marko Keskinen \(2019\): 'A framework for assessing water security and the water-energy-food nexus – the case of Finland' in Sustainability, 11\(10\).](#)
- [Medical Products Agency \(2015\): Restnoteringar av läkemedel – fortsatt utredning.](#)
- [MSB \(2018\): Så bygger vi säkerhet i Norden: Ett svenskt myndighetsperspektiv.](#)
- [MSB \(2016a\): Försörjningssäkerhet i andra länder – En kunskapsöversikt.](#)
- [MSB \(2016b\): Samverkansområdet Ekonomisk säkerhet \(SOES\).](#)
- [MSB \(2015\): Vägledning i att ta emot internationellt stöd.](#)
- [NATO Energy Security Centre of Excellence \(2019\): Energy security: Operational highlights – beyond the era of fossil fuels.](#)
- [NATO \(2018\): NATO's role in energy security.](#)
- [Natural Resources Institute Finland \(2018\): Wood imports increased clearly in 2018.](#)
- [NESA \(2019a\): Objectives.](#)
- [NESA \(2019b\): Kyber-terveys -hanke valmistuu. 18 September.](#)
- [NESA \(2017\): Ruokapalvelut osana päivittäistavarahuoltoa.](#)
- [NESA \(2015\): Energiapula – pohjoismaisen sähköverkon mahdollisen häiriön hallinta.](#)
- [NESA \(2013\): Suomen sisäiset lentokuljetukset ja niiden merkitys huoltovarmuudelle.](#)
- [NESA \(2011\): LOGHU3: Johdon yhteenvedo.](#)
- [Nordea \(2017\): Nordic banks collaborate on fighting cybercrime. 17 April.](#)
- [Nordhels \(2002\): Nordic Public Health Preparedness Agreement.](#)
- [Nordic Council and Nordic Council of Ministers \(2018\): Nordic Council: Cyber threats should be tackled by way of closer co-operation. 10 April.](#)
- [Nordic Statistics \(2019a\): ENER06: Indigenous production of energy, 1000 tonnes oil equivalents by reporting country, all products and time.](#)
- [Nordic Statistics \(2019b\): AREA02: Land use, sq. km by reporting country, use and time.](#)
- [Norges Bank \(2019\): 2019 Finansiell Infrastruktur.](#)
- [Norway – Finland \(2006\): Avtale mellom Norge og Finland om opprettholdelse av vare- og tjenestebyttet i krigs- og krisesituasjoner.](#)
- [Norway \(2018\): Forskrift om et råd for drivstoffberedskap og drivstoffnæringens beredskapspliker.](#)
- [Norway \(2012\): Act on Business and Industry Preparedness.](#)
- [Norway \(2006\): Forskrift om beredskapslagring av petroleumprodukt.](#)
- [Norway \(2004\): Forskrift om elektronisk kommunikasjonsnett og elektronisk kommunikasjonstjeneste \(ekomforskriften\).](#)
- [Norwegian Communications Authority \(2017\): Robuste og sikre nasjonale transportnett – målbilder og sårbarhetsreducerende tiltak.](#)
- [Norwegian Directorate of Health \(2019\): Nasjonal legemiddelberedskap: Vurderinger og anbefalinger.](#)
- [Norwegian Ministry of Defence and Norwegian Ministry of Justice and Public Security \(2018\): Support and Cooperation: A description of the total defence in Norway.](#)
- [Norwegian Ministry of Local Government and Modernisation \(2015–2016\): Meld. St. 27: Digital agenda for Norge – IKT for en enklere hverdag og økt produktivitet.](#)
- [Norwegian Ministry of Petroleum and Energy \(2020\): Det norske energisystemet.](#)
- [Norwegian Ministry of Petroleum and Energy \(2019a\): Tildelingsbrev til Norges vassdrags- og energidirektorat for 2019.](#)
- [Norwegian Ministry of Petroleum and Energy \(2019b\): Ownership in the Energy Sector.](#)
- [Norwegian Ministry of Petroleum and Energy \(2019c\): Security of Electricity Supply.](#)
- [Norwegian Ministry of Petroleum and Energy & Norwegian Petroleum Directorate \(2019\): Exports of oil and gas.](#)

- NTB (2019): Regjeringen dropper beredskapslager av korn. Aftenposten. 8 October.
- Nyhamar, Tore (2019): A future Nordic alliance? – prerequisites and possible operations. FFI.
- OECD (2019a): Good governance for critical infrastructure resilience.
- OECD (2019b): Global forum on digital security for prosperity.
- OECD (2019c): Critical information infrastructures protection (CIIP).
- OECD (2019d): Digital security and resilience in critical infrastructure and essential services. Digital Economy Papers, no. 281.
- OECD (2019e): 'Critical infrastructure resilience case-study: Electricity transmission and distribution in Finland' in OECD (2019): OECD reviews of risk management policies.
- OECD (2019f): Acquisition- and ownership-related policies to safeguard essential security interests: Current and emerging trends.
- OECD (2019g): 'Disruptions in freight transport' in OECD (2019): ITF Transport Outlook 2019.
- OECD (2018): Ownership and governance of state-owned enterprises: A compendium of national practices.
- Ollila, Jorma (2017): Nordic energy co-operation: Strong today – stronger tomorrow. Nordic Council of Ministers.
- Oriola (2017): Oriola Corporation's third quarter result impacted by distribution disruptions in Finland. 12 October.
- P27 (2020): P27 Nordic Payments.
- Palva, Marianne (2015): Suomen Pankin rooli maksuliikkeen kehityksessä: kansallisista järjestelmistä yhteiseurooppalaisiin järjestelmiin. Bank of Finland.
- Pelkonen, Antti, Toni Ahlqvist, Anna Leinonen, Mika Nieminen, Jarno Salonen, Reijo Savola, Pekka Savolainen, Arho Suominen, Hannes Toivanen Juha Remes, Jukka Kyheröinen (2016): Kyberosaaminen Suomessa – nykytila ja tiekartta tulevaisuuteen.
- PTS (2020): Total defence.
- PTS (2018): Risk- och sårbarhetsanalys för PTS och dess ansvarsområden 2018.
- PTS (2016): 2016-års risk- och sårbarhetsanalys för PTS och dess ansvarsområden.
- PTS (2015): Post- och telestyrelsens föreskrifter om krav på driftsäkerhet.
- Pöyry (2019): Huoltovarmuus energiamurroksessa – raportti Huoltovarmuuskeskukselle.
- Rautiainen, Pekka and Irmeli Rinta-Keturi (2011): LOGHU3: Toimintaympäristön kehittyminen. NESÄ.
- Ries, Tomas (2014): 'Global Flow Security: A Conceptual Framework' in Brattberg, Erik & Daniel Hamilton (eds.): Global Flow Security: A New Security Agenda for the Transatlantic Community in 2030. Washington, DC, Center for Transatlantic Relations, Johns Hopkins University.
- Roepke, Wolf-Diether and Hasit Thankey (2019): Resilience: The First Line of Defence. The Three Swords Magazine.
- Sabbagh, Dan (2019): China 'must clean up its cyber act' for Huawei to be used in 5G network. The Guardian. 11 September.
- Sarnola, Kati and Johanna Linnolahti (2019): 'A regulatory perspective on the availability of medicines and medicine shortages in outpatient care: case Finland' in International Journal of Clinical Pharmacy, 41(4).
- Security Committee (2019): Finland's cyber security strategy 2019.
- Security Committee (2017): The security strategy for society. Government resolution / 2 November 2017.
- Solsvik, Terje (2018): Norway sells remainder stake in SAS airline'. Reuters. 27 June.
- Statistics Finland (2019): Energy in Finland.
- Statistics Finland (2018): Use of renewable energy sources grew in electricity and heat production in 2017.
- Statistics Norway (2019a): Kollektivtransport.
- Statistics Norway (2019b): Bil og transport.
- Statistics Norway (2019c): 11403: Innenlandsk godstransport, etter statistikkvariabel og år.
- Statistics Norway (2017): Godset likt fordelt mellom båt, bil og røyrløydning.
- Statistics Sweden (2019): Agricultural statistics 2019 including food statistics – tables.
- Statkraft (2020): Dette bør du vite om vindkraft i Norge.
- Stebbins, Robert A. (2001): Exploratory Research in the Social Sciences. London, SAGE Publications.
- Swedberg, Richard (2018): 'On the Uses of Exploratory Research and Exploratory Studies in Social Science' in Elman, Colin, John Gerring and James Mahoney (eds.) (forthcoming): The Production of Knowledge. Cambridge, Cambridge University Press.
- Sweden (2015a): Förordning (2015:1053, 4 §) om totalförsvar och höjd beredskap.
- Sweden (2015b): Förordning (2015:1052) om krisberedskap och bevakningsansvariga myndigheters åtgärder vid höjd beredskap.
- Sweden (2015c): Förordning (2015:284) med instruktion för Socialstyrelsen.
- Sweden (2014): Förordning (2014:520) med instruktion för Statens energimyndighet.
- Sweden (2009): Förordning (2009:1426) med instruktion för Livsmedelsverket.
- Sweden (2007): Förordning (2007:1119) med instruktion för Affärsverket svenska kraftnät.
- Sweden (2003): Lag (2003:389) om elektronisk kommunikation.
- Sweden (1997): Elberedskapslag (1997:288).
- Sweden (1992): Lag (1992:1403) om totalförsvar och höjd beredskap.
- Sweden – Norway (1986): Protokoll om handel mellan Sverige och Norge i internationella krislägen.
- Swedish Association for Road Transport Companies (2016): Fakta om åkerinäringen.
- Swedish Ministry of Defence and Ministry of Justice (2018): Development of modern total defence.
- Swedish Ministry of Enterprise (2017): Trafikverket ska samordna krisberedskapen och det civila försvaret inom transportområdet. 29 June.
- Swedish Energy Agency (2019a): Återupptagen planering civilt försvar.
- Swedish Energy Agency (2019b): Energiindikatorer 2019 – Uppföljning av Sveriges Energipolitiska mål.
- Swedish Energy Agency (2018): Vägen till ett 100 procent förnybart elsystem. Delrapport 1: Framtidens elsystem och Sveriges förutsättningar.
- Swedish Energy Agency (2015): Risk- och sårbarhetsanalys över energiförsörjningen i Sverige år 2015.
- Swedish Energy Agency (2013): Ansvar och roller för en trygg energiförsörjning – Energimyndighetens analys.
- Swedish Food Federation (2019a): Fakta och statistik.
- Swedish Food Federation (2019b): Hur stor andel av livsmedlen som säljs på marknaden är producerade i Sverige?
- Swedish Food Federation (2019c): Svensk handel med jordbruksvaror och livsmedel 2018.
- Swedish National Audit Office (2018): Livsmedels- och läkemedelsförsörjning – samhällets säkerhet och viktiga samhällsfunktioner.
- Telegeography (2020): Submarine cable map.
- Telenor (2019): Tender offer for sales in DNA PLC.
- Telia (2018): Market and Brands.
- Tieto (2019): Tieto and EVRY are joining forces to create a leading Nordic digital services company.
- Transport Analysis (2019a): Fordon 2018. Statistik 2019:4.
- Transport Analysis (2019b): Bantrafik 2018. Statistik 2019:17.
- Transport Analysis (2019c): Sjötrafik 2018. Statistik 2019:15.
- Transport Analysis (2019d): Luftfart 2018. Statistik 2019:8.
- Wilson, Alex (2016): International Energy Agency: Origins and developments. European Parliamentary Research Service.
- Wimmer, Andreas and Nina Glick Schiller (2002): 'Methodological Nationalism and Beyond: Nation-state Building, Migration and the Social Sciences' in Global Networks, 2(4).
- Wired (2018): The untold story of Notpetya, the most devastating cyberattack in history. 22 August.
- World Health Organization (2020): Essential medicines.
- Yle (2019): Cyber attack in Lahti disrupts city services. 12 June.
- Yle (2018): Nordic, Baltic stock exchange openings delayed by knockout of Nasdaq data centre. 18 April.

Interviews directly referred to in the report

All interviews conducted in 2019.

Bank, Finland, 18 September.

Bank, Finland, 26 September.

Cyber security company, Finland, 12 August.

Cyber security company, Finland, 21 August.

Drivkraft Norge, 4 November.

Energy company, Finland, 10 September.

Energy company, Finland, 17 September.

Finans Norge, Norway, 11 October.

Hdir, Norway, 26 September.

National Board of Health and Welfare,
Sweden, 5 September.

NESA, Finland, 2 May.

NESA, Finland, 7 May.

NESA, Finland, 8 May.

NESA, Finland, 14 May.

NESA, Finland, 13 June.

NESA, Finland, 22 October.

NESA, Finland, 23 October.

NFD, Norway, 24 September.

Norges Bank, Norway, 2 October.

NSM, Norway, 18 September.

Orkla, Norway, 23 September.

Pharmaceutical distributor, Finland, 16 August.

Pharmaceutical distributor, Finland, 17 September.

Riksbank, Sweden, 27 August.

Shipping company, Finland, 29 August.

St1, Norway, 5 November.

Statnett, Norway, 19 September.

Swedish Bankers' Association, Sweden, 22 October.

Swedish Energy Agency, Sweden, 4 September.

Swedish Food Agency, Sweden, 26 August.

Swedish International Freight Association,
Sweden, 3 November.

Swedish Post and Telecom Authority,
Sweden, 29 August.

Swedish Transport Administration,
Sweden, 3 September.

Telecommunications provider, Finland, 14 August.

TP SAMS, Sweden, 8 October.

