

Digitalisation as a tool for sustainable Nordic regional development

Preliminary literature and policy review

Discussion paper prepared for Nordic thematic group for innovative and resilient regions

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Introduction

Nordregio, on behalf of the *Nordic thematic group for innovative and resilient regions 2017-2020*, under the *Nordic Council of Ministers' Committee of Civil Servants for Regional Affairs*, is undertaking an in-depth study: *Digitalisation as a tool for sustainable Nordic regional development* throughout 2017-2018. The in-depth study explores digitalisation in Nordic regions by studying how regional authorities are implementing national and regional digital strategies, and the different types of actors (public sectors, companies, civil society) and actor constellations that are key in the digital transformation of Nordic regions. This discussion paper reports on the preliminary findings of the first phase of the project: Policy and literature review.

The report is designed to provide a foundation for the remainder of the in-depth study which will include regional case studies in all Nordic countries to be conducted in 2018. Specifically, the report contributes to the project by:

- Developing a common understanding of digitalisation to guide the project.
- Positioning the Nordic Region in a global and European context with respect to digitalisation.
- Highlighting the key considerations relevant to digitalisation as a tool for sustainable Nordic regional development.
- Providing an overview of digitalisation policies at the EU and Nordic national levels.
- Presenting brief snapshots of selected local and regional Nordic examples of digitalisation to inspire case study selection.

It closes with some overall conclusions and an overview of the next steps for the in-depth study in 2018.

This discussion paper has been made publicly available with the aim of encouraging engagement with Nordregio's research while it is still in progress. As such, the findings presented here are preliminary and should be treated as such by the reader. Nordregio welcomes constructive feedback on the paper and hopes that this open process will ultimately contribute to a better result. The final report on the project will be available in late 2018 at www.nordregio.se.

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More information on the Nordic thematic group for innovative and resilient regions 2017-2020: <http://www.nordregio.se/en/Metameny/About-Nordregio/Nordic-thematic-groups/Innovative-and-resilient-regions/>

Overview of discussion paper

This paper reports the preliminary findings of a literature and policy review that was conducted as part of the in-depth study: *Digitalisation as a tool for sustainable Nordic regional development*. The study is being conducted by Nordregio in 2017-18, on behalf of the *Nordic thematic group for innovative and resilient regions 2017-2020*, under the *Nordic Council of Ministers' Committee of Civil Servants for Regional Affairs*.

For the purposes of the in-depth study, digitalisation is defined as: the transformation of all sectors of our economy, government and society based on the large-scale adoption of existing and emerging digital technologies. This definition is thought to be instructive as it emphasises the transformative aspect of digitalisation, explicitly includes all actors, and highlights the importance of large-scale adoption of technologies as a precursor for change.

From a regional development perspective, there are a range of social, economic and environmental aspects to be considered. Even in the Nordic countries, access to digital infrastructure is still subject to geographical variation and a rural-urban digital divide represents a challenge. There are also inequities with respect to the labour market impacts of atomisation, with areas outside of large cities more vulnerable to job losses. Digitalisation can foster green transition through developing smart city solutions and supporting sustainable business activities in the rural areas. Addressing the challenges and embracing the opportunities associated with digitalisation will require innovative, coordinated, and multi-level governance approaches that foster interaction between citizens, business, non-governmental organisations and public administrations.

The Nordic countries are widely accepted as digital frontrunners in a European and even a global context. Thus, perhaps unsurprisingly, all Nordic countries are in the process of implementing national strategies related to digitalisation. Overall, these policies have fairly similar goals with a focus on digital public services, supporting growth and innovation in business and ensuring digital security. Digital competence is also addressed by each country in varying ways.

At present, the interaction between regional and national policy making in the Nordic countries appears to be quite diverse. In Denmark, the joint national strategy is developed with contributions from the regions and binds all levels of public administration. In Finland, there is no specific push for regional digital agendas from the national level, however some regions and municipalities have drawn up digital agendas by their own initiative. In Iceland and Norway collaboration is encouraged, with the national goals shaping regional agendas and vice-versa. In Sweden, each region has developed a digital agenda based on the 2011 National Digital Agenda. Nordic cooperation on digitalisation is apparent but, as yet, appears to be mostly top-down with no Nordic countries including mention of Nordic cooperation in their national strategies.

Digitalisation is a broad concept with far-reaching consequences for all levels of government, business and society. Regional policy making in this field is in its infancy and specific approaches appear to be broad in nature, as well as differing based on the specific characteristic of countries and regions. As such, it is recommended that the project takes a broad approach, exploring cases from different types of regions within the frame of digitalisation as a tool for sustainable Nordic regional development.

1 Understanding digitalisation

The primary purpose of this knowledge overview is to develop a shared understanding of the concepts associated with digitalisation, with a focus on their relevance in a Nordic regional development context. This work will set the scene for the remainder of the TG2 2017-2018 in-depth study: *Digitalisation as a tool for sustainable Nordic regional development*. The first task is to develop a definition of digitalisation to be used throughout the project based on selected literature on the topic. We go on to position the Nordic Region in a European and global context. Finally, a broad overview of the main theoretical considerations relevant to digitalisation in a regional development context is provided.

1.1 Defining digitalisation

As with many emerging concepts, there is no shortage of definitions to choose from. This section will consider the merits of several before arriving at one most useful for the current project. According to Sabbagh and his colleagues (2013), 'Digitalisation is the mass adoption of connected digital services by consumers, enterprises, and governments, and is a key economic driver that accelerates growth and facilitates job creation' (p. 35). This definition understands digitalisation as an active process that requires not only the development of new technologies but their large-scale adoption by different groups in society. It positions digitalisation as positive from an economic perspective, focusing on job creation and economic growth. Even if the ultimate outcome of digitalisation is to be a net-gain with respect to jobs, defining digitalisation in relation to job creation alone may be somewhat simplistic (Degryse 2016). This positioning also has the potential to alienate those who are negatively affected by changes to the labour market in the short term.

The definition from Sabbagh et al (2013) also fails to highlight the transformative element of digitalisation. As the European Commission (2015) explains:

Information and Communications Technology (ICT) is no longer a specific sector but the foundation of all modern innovative economic systems. The Internet and digital technologies are transforming the lives we lead, the way we work – as individuals, in business, and in our communities as they become more integrated across all sectors of our economy and society. (p. 3)

Thus, although the technologies themselves are new, digitalisation – the large-scale adoption of these technologies into different parts of society – can be more accurately be understood as a series of changes to existing facets of life. This is a vital detail from a policy perspective as it signals a societal change that goes beyond the purview of a specific government department and instead has the power to reshape every element of our societies. Given this, the transformative qualities of digital technologies are perhaps equally important as the novel aspects.

This is further elaborated by Alm et al (2016), who define digitalisation as 'the broad adoption of digital technology in homes, businesses and the society as a whole' (p. 14), explaining that:

Digitalisation constitutes a transformative shift in technology across industries and society in general. It fundamentally changes the way people live, work and communicate, and how they shop for and produce goods and services. It changes the way companies are run, how customers are acquired, and how enterprises do business. (p. 6)

This definition incorporates both the actions associated with digitalisation (large-scale adoption of digital technologies) and its transformative qualities. Where it falls short however, is that it fails to make any reference to the role of the public sector – beyond its presumable inclusion in 'society as a whole'. This consideration is vital in the Nordic context.

It should be noted that each of the definitions highlighted above was taken from a report or article which served a particular purpose. As such, the critique provided here is not designed to discount

them, but rather to highlight the strengths and weaknesses of each in the context of the current project. Based on this critique, and borrowing from the definitions above as appropriate, we suggest that for the purposes of the in-depth study: *Digitalisation as a tool for sustainable Nordic regional development* digitalisation is defined as follows:

Digitalisation is the transformation of all sectors of our economy, government and society based on the large-scale adoption of existing and emerging digital technologies.

Thus, digitalisation is the transformation and the technologies are the tools through which it will occur. Importantly, this transformation is contingent on the adoption of the technologies at a large-scale. Some of these technologies already exist and have been adopted to varying degrees, for example, mobile internet, the internet of things (IoT) and artificial intelligence (AI) (Manyika et al, 2013). Others exist but are yet to be adopted at a scale necessary to have any meaningful impact on the way we live, for example 3D printing, next generation genomics (Manyika et al, 2013). Still more are at varying stages of development, with their transformative aspects unclear, for example advanced materials. Finally, there are no doubt technologies that will play a role in the digital transition that are yet to be imagined. Descriptions of these, and other digital technologies can be found in *Appendix I: Digital technologies with high transformative potential*.

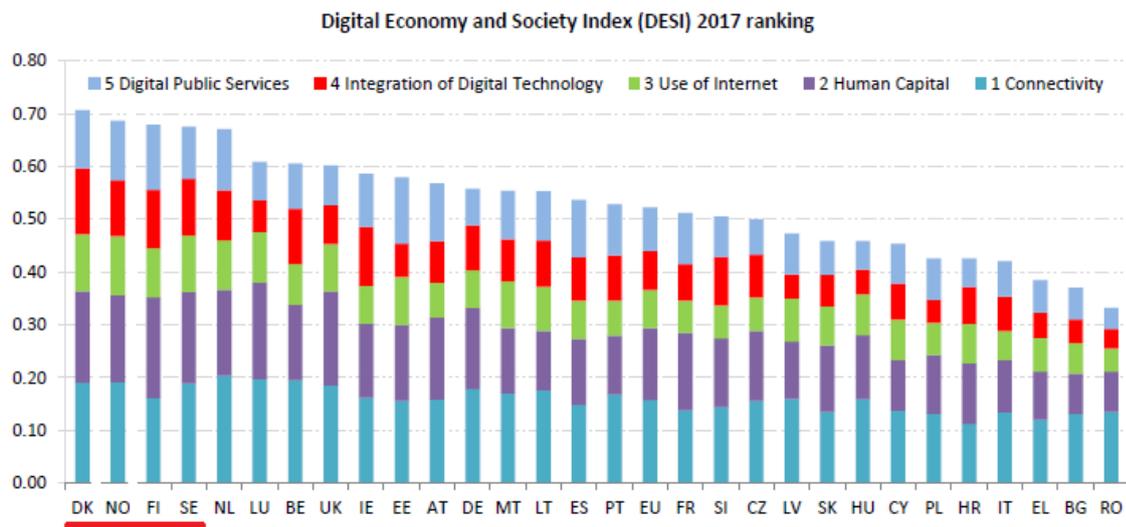
Importantly, this definition was found to be consistent with the ways in which digitalisation is discussed in the national strategies of the Nordic countries which are reviewed in section 2 of this paper. Here, digitalisation is understood as impacting all elements of the society (Denmark, Sweden, Finland) in a fundamental way (Norway), being dependant on the adoption of the technologies at a large scale (Finland), and constantly emerging (Iceland, Finland). The way that digitalisation is understood in the different countries will be considered in more depth in the final report based on the data collected in the case study regions.

1.2 Digitalisation in the Nordic Region – A European and global context

The Nordic countries are often positioned as digital frontrunners in both a European and a Global context. In the European Commission's *Digital Economy and Society Index (DESI)* Denmark, Finland, Sweden and the Netherlands (in that order) top the list in terms of overall ranking as well as performing well on individual indicators.¹ The ranking is based on five aspects: 1) Connectivity (fixed broadband, mobile broadband, speed, affordability); 2) Digital skills (basic skills and usage, advanced skills and development); 3) Use of internet (content, communication, transactions); 4) Integration of digital technology (business digitisation, ecommerce); and 5) Digital public services (eGovernment) (European Commission, 2017a).

¹ Iceland is not included in this index but report on Iceland is provided.

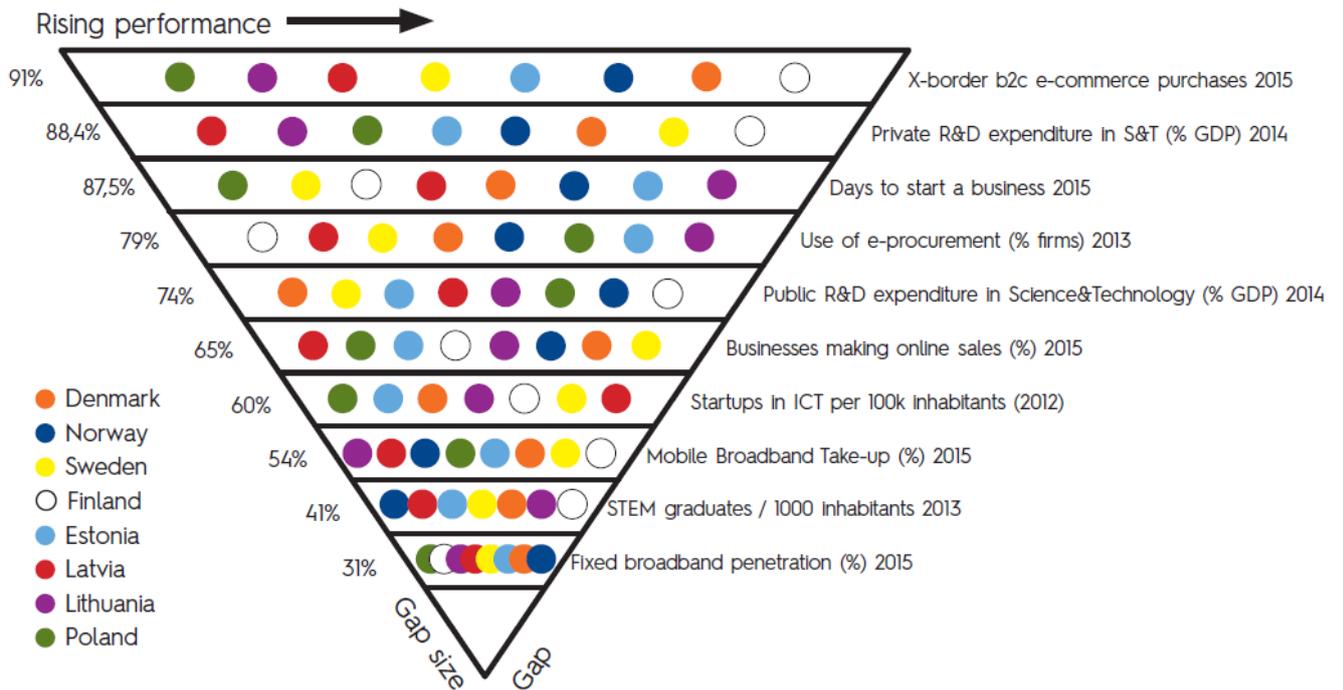
Figure 1: Digital Economy and Society Index, 2017 ranking. Source: European Commission



Zooming in, we see that Finland leads the way on digital skills (1) and digital public services (2) but lags behind on connectivity (12). Denmark is ranked highest on internet use (1) and integration of digital technology (1) and connectivity (4), but falls behind slightly on digital skills and digital public services. Norway performs very well in the provision of public services, ranks high in internet users and the use of internet services but could improve its score in business digitalization. Sweden sits around the middle on all measures, with the exception of digital public services, where it falls slightly behind (8). Iceland has much higher connectivity (fixed broadband), basic digital skills among the users and digitalization of public services when compared to the EU. These between country differences will be explored in more depth in Part 2 of this report.

Alongside the agenda at the European scale, work has also occurred to map the state of play with respect to digitalisation in the Nordic Baltic Region (Wernberg & Andersson 2016). Two reports have been released thus far mapping the status of indicators across the Nordic Baltic States, with the most recent having a particular focus on cities. The Nordic countries perform well in the Nordic Baltic context, there is again however substantial variation in performance based on different indicators. Figure 2 shows the performance of each state on different indicators with a focus on the size of the gap between the countries on each indicator. For indicators nearer the top of the figure gaps between countries are quite large and for indicators towards the bottom the gaps are smaller.

Figure 2. Performance of Nordic Baltic countries on selected digitalisation indicators. Source: Wernberg & Andersson 2016



Another report, this time based on Boston Consulting Group's *E-Intensity Index*², includes Denmark, Finland, Norway and Sweden among nine European "digital frontrunners"³ (Alm et al 2016⁴). The report highlights the higher share of e-GDP⁵ in these countries (average of 8%) when compared to what it terms the 'EU Big 5'⁶ (average 5.1%). Accordingly, the research suggests that these countries stand to make the most gains from further digital advancement, in particular, full realisation the European Digital Single Market (DSM) and further digitalisation in emerging fields (e.g. Internet of Things, advanced robotics, big data analysis, augmented/virtual reality).

At the same time, the authors argue that these countries also have more to lose if Europe fails to keep up with the rest of the world. They are highly critical of European action towards digitalisation, suggesting that 'the window of opportunity is closing fast' for Europe to position itself as a global leader in this space (Alm et al 2016, p. 19). It estimates that, based on the current pace of development, even the frontrunner nations will be behind China, South Korea, Singapore and Taiwan by 2025 (Alm et al 2016), suggesting that the frontrunners need to work together to share good practice (all are strong in different areas) and take on a leadership role. This includes both

² A global index is based on three equally weighted dimensions: 1) Enablement (mobile internet, fixed internet, overall bandwidth); 2) Expenditure (online retail, mobile retail, online adds); 3) Engagement – broken down by: business (business internet use, ICT impact); consumer (internet use, online media and social activity); and government (e-Government, e-Education)

³ The others were: Belgium, the Netherlands, Estonia, Ireland, and Luxembourg

⁴ It should be noted that this report was commissioned by Google.

⁵ e-GDP is a measure that incorporates all economic activity that is conducted online. It encompasses other sectors rather than reducing their share and so could theoretically reach 100% if all economic activity was conducted online. Interestingly, the figures on e-GDP quoted above indicate that, at least in simple economic terms, the process of digitalisation is still at an early stage. Even in the digital frontrunner countries, 92% of economic activity⁵ still occurs offline (Alm et al 2016).

⁶ Germany, France, the UK, Spain and Italy

ideological leadership – to address the concerns of more pessimistic nations – and practical leadership – targeting the currently broad EU strategy (Alm et al 2016).

These general aspects have also enabled Nordic cities to be forerunners in various smart technology solutions, including the management of urban systems and environments. Nordic cities have been early adopters of sound information and communication technology (ICT) infrastructures in cities, and of knowledge expansion through the implementation of smart city solutions. This builds on a long tradition of developing infrastructure to support the digitalisation of public services in the public sector. For example, Finland was the first country to declare that broadband access is a legal right for every citizen, and Sweden ranks fourth in the world in the percentage of fixed broadband subscriptions on fibre-optic networks (Aguar Borges et al. 2017). Sweden is among the most successful countries in developing community-based broadband initiatives, so called 'local fibre networks'. The Swedish Local Fibre Alliance has supported local governments and communities to plan and launch municipally owned and managed networks (86%) (ENRD 2017). The Swedish government is committed to providing expanded high-speed internet to rural areas, and Stockholm is expected to be the first city in the world with a 5G network in 2018 (Aguar Borges et al. 2017).

In terms of provision of public services, recent research has found Nordic cities to be the most digitally advanced in Europe, independent of city size (ESPON 2017). The study also showed that there is a generally high confidence level regarding the readiness of cities to respond to digital transition and seize the opportunities of digitalisation.

1.3 Digitalisation and regional development

When thinking about digitalisation as a tool for sustainable Nordic development, it is important to consider social, economic and environmental aspects. From a social perspective, there is a need for equal access to digital technologies. This concerns the provision of digital infrastructure, but also means working to support groups who may experience barriers to engagement with digital technologies due to, for example, age, socio-economic status or lack of digital skills. From an economic perspective, it is necessary to understand the ways in which digitalisation is impacting the labour market, both through the automation of existing work functions and through the creation of new jobs requiring different types of skills. Labour market impacts also relate to social sustainability as we see that job destruction and job creation is not necessarily happening in the same places. From an environmental perspective, digital technologies are making cities and regions "smarter", reducing consumption, lowering carbon emissions and improving quality of life for residents. Given this, it is clear that digitalisation presents societal challenges that will require innovative, coordinated and multi-level governance approaches that foster interaction between citizens, business, non-governmental organisations and public administrations. The following sections will address each of these areas in turn.

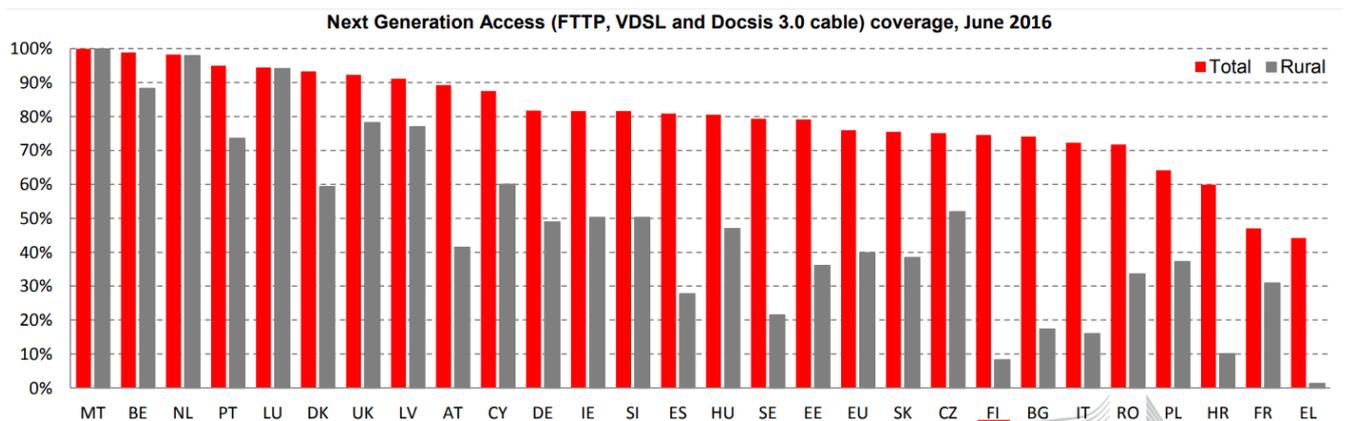
1.3.1 Digital access

At the most basic level, it is important to acknowledge that access to digital technologies is by no means equal, and that digitalisation presents both opportunities and challenges for regional development. Inequity of access with respect to digital technology is often referred to as the digital divide. There are persistent disparities between urban and rural areas with respect to the availability of digital infrastructure and the adoption of digital technologies. On the supply side, rural areas are lagging when it comes to the provision of Next generation access (NGA) infrastructure (see Figure 3). On the demand side, a lack of skills and knowledge regarding digital technology in rural areas limits their possibilities for innovative service provision, business or customer use (ENRD 2017). Thus, the challenges of digitalisation are not strictly related to technological issues. There are also challenges associated with changing behaviour and improving knowledge about how to develop and

use digital urban services (Aguar Borges et al. 2017). To ensure sustainable regional development, it is crucial to address digital divide between urban and rural areas, at both supply and demand side.

The digital divide also has an individual component, and can relate to socio-economic status, age, gender and health. Consequently, large share of citizens in urban areas also lack the infrastructure and competencies required for full participation in a digital life. As with other forms of social stratification, elements of disadvantage are cross-cutting. For example, an elderly person living in a rural community may be subject to a “double digital divide”.

Figure 3. Next Generation Access coverage in rural areas, Source: European Commission (2017)



1.3.2 Digitalisation and the labour market

There are also spatial disparities with respect to the impact of digitalisation on the labour market. Several forces are at play here. First, there is considerable discussion about the potential for automation to destroy, or change the nature of, existing jobs (Autor 2015; Berger & Frey 2016; Degryse 2016). Typically, tasks that can be automated are those which achieve consistent results by following well understood and predictable procedures and which do not require flexibility, judgement or common sense. Importantly, automation does not necessarily mean replacing humans altogether. It may apply only to certain tasks within a work role. In most cases, this results in a greater demand for high level analytical and/or interpersonal skills in the remaining human component (Berger & Frey 2016). This can result in a lack of digital skills, slowing down digital development in some sectors (Berger & Frey 2016; ESPON 2017). Until now, the most substantial job destruction has occurred in middle-skilled professions (e.g. book-keeping, clerical work, data entry), however artificial intelligence is increasingly raising the possibility of automation in high-skilled professions (Autor 2015; Berger & Frey 2016).

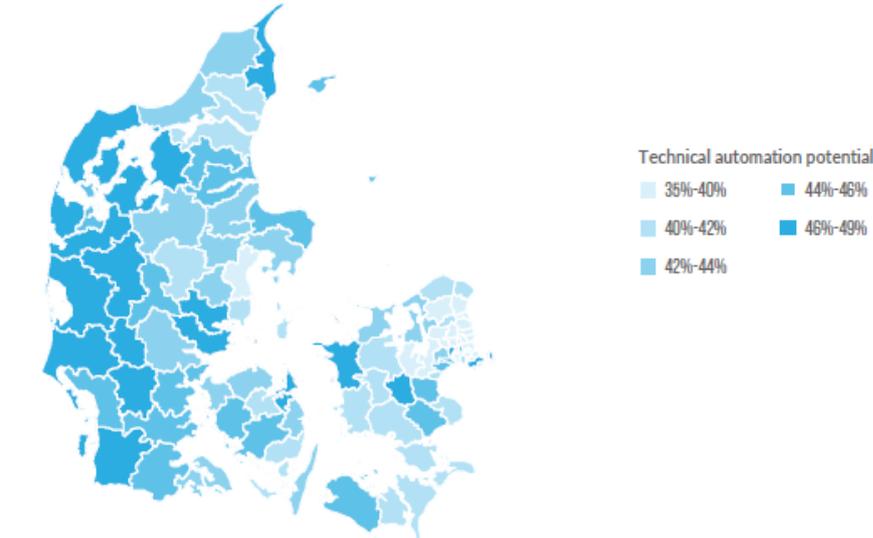
At the same time, there is considerable discussion about the potential for job creation through digital technologies (Alm et al 2016; Degryse 2016; Sabbagh et al 2013). From a regional development perspective, it is important to consider the territorial conditions under which job creation will occur. In the late 1990s - early 2000s, a body of literature emerged suggesting that digital technologies would signal the ‘death of distance’, allowing social and economic activities to become increasingly detached from physical proximity (Läppe 2001). This idea has been widely refuted since, an argument that is perhaps best articulated by Morgan (2004), who argues that:

[The ‘death of distance’] thesis grossly over-estimates the distance-destroying capacity of ICT by conflating spatial reach with social depth. Because *information* diffuses rapidly across organisational and territorial borders, it wrongly assumes that *understanding* does too. (Morgan 2004, p. 3, emphasis in original)

In fact, rather than a declining role for physical proximity, territorial factors have become increasingly important to business innovation. This is evidenced in the emergence of regional innovation clusters (Morgan 2004; Soete 2006), as well as in the increasing competitiveness between cities on the global stage in different industries (Kourtit 2016; Scott 2013).

This has substantial consequences for regional development in the context of digitalisation. Evidence suggests that new industries (and the associated jobs) are mostly emerging in cities already rich in high-skilled jobs (Alm et al 2016; Berger & Frey 2016; Degryse 2016). Thus, the places where jobs are least vulnerable to automation are also the places that are most likely to experience job creation (Berger & Frey 2016). This presents particular challenges in the context of the Nordic Region, which is characterised by both high levels of urbanisation and substantial peripheral, rural and sparsely populated areas. As an example, a recent report on the impact of automation in Denmark published by The Tuborg Research Centre For Globalisation and Firms and McKinsey & Company (2017) calculated the potential for automation at the municipal level. As can be seen in Figure 4, the potential was lowest in and around the capital region and highest in more peripheral municipalities.

Figure 4. Aggregated technical automation potential by municipality, percent of working hours. Source: The Tuborg Research Centre For Globalisation and Firms and McKinsey & Company (2017)



1.3.3 Digitalisation and the green transition

When it comes to the environmental component of sustainability and digitalisation, there is a strong focus in the literature on “smart” cities. Smart city initiatives are increasingly common and involve adopting functions such as automation, machine learning and the internet of things to support city functions, reduce consumption and improve quality of life for residents. Smart city solutions also facilitate the green transition, including intelligent public transport systems to reduce carbon emissions, smart grid solutions for more efficient energy systems, as well as waste and water management. Moreover, smart city solutions are used to monitor and reduce environmental challenges such as air pollution (Aguiar Borges et al. 2017; IoT Agenda 2017).

The “smart city” concept has been recently extended to include rural areas through the “Smart Villages” concept. This concept was adopted by the European Commission in 2016, and calls for

'policies to pay particular attention to overcoming the digital divide between rural and urban areas and to develop the potential offered by connectivity and digitisation of rural areas' (European Commission 2016a). This work seeks to recognise that innovation and digitisation are equally important for green and sustainable rural areas, with a particular focus on developing circular and bio-economy and creating high-quality jobs in the agriculture sector.

Digital technologies and innovations in rural areas may support quality of life, higher standard public services for citizens (e.g. transport and mobility solutions), better use of resources, reduce impact on the environment, and contribute to develop new opportunities for rural value chains, thereby supporting both inhabitants and businesses (European Commission 2016a). In the context of regional development digitalisation can contribute to diminishing the two mutually reinforcing trends that many regions are facing– firstly, a shortage of jobs and sustainable business activity and secondly, inadequate and declining services (ENRD 2017). However, 'this potential will only be fulfilled if rural communities are given the full benefits of digitisation and connectivity' (European Commission 2017b). In this context, we must work to ensure that the digital conversation goes beyond the "smart city", acknowledging also the concerns of rural, peripheral and sparsely populated regions, for example, mobility solutions, access to digital public services.

Digitalisation also contributes to green transition through enabling fast expansion of business models that promote sustainable consumption through the "sharing" of goods and services through digital platforms. This phenomenon is generally referred to as the sharing economy and in 2015 was estimated to have a global net worth of \$150BN USD (Alm et al 2016). Commonly cited international examples include Airbnb (users rent their home or part of their home to other users), Uber (users provide lifts to other users) and Upwork (links free-lance workers with potential employers, generally for the purpose of performing short term, project-based, work). The term itself is heavily contentious, primarily because the so-called 'sharing' often (though not always) involves a financial exchange between the two parties (Degryse 2016). There are however many local-level examples that do promote 'sharing' in the traditional sense (e.g. Skjutsgruppen, the Swedish ride sharing platform). More information about the sharing economy in the Nordic context can be found in: Nordic labour markets and the sharing economy – Report from a pilot project (Dølvik & Jesnes 2017).

1.3.4 Governance of digitalisation

There are two ways of thinking about government in the context of the digital transition. The first involves the digitalisation of government itself through the digitisation of public services and processes. This is occurring across Europe to varying degrees based on the country and the type of service. A recent survey by ESPON (2017) designed to explore the digitalisation of public services in European regions found that the highest levels of digitalisation were occurring in the fields of spatial planning and construction; tourism; culture, leisure, sports; e-inclusion to governance; and education. Services most likely to be lagging behind were health; social and welfare services; and road infrastructure and parking related services. This survey also explored the main drivers and constraints to the provision of digital public services. For Northern European respondents, the main drivers were found to be a desire to modernise the city's services, improving citizen experience and increasing internal efficiency (ESPON 2017). Conversely, the main factors found to be constraining were a lack of funds and skills, as well as lack of an overall strategy in case of smaller cities (ESPON 2017).

Digital technologies can also be used by governments to promote collaborative approaches to public policy making, creating more open, transparent, innovative, participatory and trustworthy governments (OECD 2014). They can foster citizen-driven approaches (citizens and businesses formulating and determining their needs in partnership with governments).

The second way of thinking about government in the context of the digital transition is with relation to its coordinating role. Governments have a responsibility to create the conditions in which other sectors can make the most of the digital opportunity. They may also need to respond in different ways to negative consequences, for example, the potential job losses described above. Successful digital transition requires multi-level governance arrangements, including both vertical and horizontal dimensions. Cross-sectorial collaboration is a key approach in realizing digital transformation. The EU eGovernment Action Plan 2016-2020 emphasizes the need to foster more systematized interaction of citizens, business and non-governmental organizations with public administrations (European Commission 2016b).

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2 Review of digitalisation policy

This section presents a preliminary overview of EU policy and Nordic digitalisation strategies at the national level, providing a basis for the study of regional digital agendas that will follow in the next phase of the project. It also provides a brief overview of other joint Nordic work in this field. The full list of resources drawn on to develop this section can be found in *Appendix II. Resources for policy review*.

2.1 EU policy

Digitalisation is highly important to the EU, and the policy agenda in this area is both vast and complex. The aim of this section is to touch briefly on the most relevant aspects by way of providing a broader context for the more detailed account of Nordic digitalisation policy that follows. The EU Digital Agenda 2020 is one of five pillars of the Europe 2020 Strategy, and provides an overarching framework for European efforts towards a digital society (European Commission 2015a). Central to the agenda is the Digital Single Market Strategy for Europe (2015b), which focuses on maximising the growth potential of the digital economy, emphasising both benefits for businesses and industries, but also EU citizens through digital services. The policy has recently undergone a mid-term review, with key achievements including the abolition of roaming charges, portability of content, and setting the stage for the development of 5G technology (European Commission 2017a). The review also identifies three main areas where further EU action is necessary, including development of the European data economy, addressing cybersecurity challenges, and promoting online platforms (European Commission 2017b).

Other EU policies of relevance are those aimed at societal aspects. The EU eGovernment Action Plan 2016-2020, identifies three priority areas, including: modernising public administrations using key digital enablers, enabling mobility of citizens and businesses by cross-border interoperability, and facilitating digital interaction between administrations and citizens/businesses for high-quality public services (European Commission 2016a). The eHealth Action Plan 2012-2020, prioritises the achievement of wider interoperability of eHealth services, support for research development and innovation, ensuring wider deployment and facilitating uptake of eHealth services, and promoting international cooperation (European Commission 2012a). The Digital Education Action Plan (2018), prioritises making better use of technologies for teaching and learning, developing relevant skills and competencies for digital transformation, and improving education systems through better data analysis and foresight. The Skills Agenda for Europe (2016b), outlines specific actions on how to ensure and support the right training and skills to the EU citizens.

The European Commission also highlights the importance of cities and regions as enablers of digital transformation as outlined in the Blueprint for cities and regions as launch-pads for digital transformation, developed by the EC's Strategic Policy Forum on Digital Entrepreneurship 2014-2016 (European Commission 2016c). The blueprint underlines the strategic role of urban and regional ecosystems in the digital transformation, calling for a strong leadership and mobilization of all local actors. The EC supports digitalisation through smart city initiatives and projects and actions that aim to build regional and local capacity in digital transformation (European Commission 2016d). The Urban Agenda for the EU (2016e) also includes digitalisation as a focus area.

Finally, it is worth noting the new data protection rules that will come into effect on 25 May 2018, based on the General Data Protection Regulation, which was adopted in May 2016. The new rules will provide consistency across the continent (including non-European companies offering services in the EU), stronger and new rights for citizens, stronger protection against data breaches and the

power to impose fines (European Commission 2018). The commission is actively supporting to member states as they prepare to implement the reform.

2.2 Digitalisation policy in the Nordic countries and independent territories

All Nordic countries have adopted digital agendas or strategies at the national level in some form or another. Table 1 provides an overview of these policies, highlighting the national priorities and the regional policy development approach of each country. The text that follows gives a slightly more detailed overview of these themes for each country, including some practical examples of Nordic regions and municipalities that are working with digitalisation in different ways. It also includes a short overview on digitalisation in each of the independent territories.

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Table 1. Digitalisation policies in the Nordic countries: An overview

	Relevant agendas and programmes	Main themes and focus areas	Regional agenda
Denmark	Digital Strategy 2016-2020: "A stronger and more secure digital Denmark" Redegørelse om Danmarks Digitale Vækst 2017	Boosting growth Effective and user-centric public sector and services Digital security and trust in digital services	The joint national strategy binds all levels of public administration. Additional regional digital agendas contribute to national goal setting. These are often sector-specific, e.g. regarding e-health.
Finland	The Finnish Government Programme (2015) Digital Agenda 2011-2020: "Productive and inventive Finland"	Digitalised public services Growth environment for future digital businesses; includes information security Transforming the education system	No push for special regional digital agendas from the national level. Some regions and municipalities have drawn up digital agendas by their own initiative.
Iceland	Iceland 2020 Icelandic State and Municipal Policy on the Information Society 2013-2016 "E-Power expansion –create, connect, participate" National Cyber Security Strategy 2015-2026	Focus on e-participation and e-government Better and more digital public services Ensuring the skills and the infrastructure needed to tackle cyber threats	The Vision 2020 is a collaborative strategy and guides regional strategies to boost e-service development in the regions. The implementation of e-government is highly decentralized.
Norway	The White Paper "Digital agenda for Norway: ICT for an easier everyday life and increased productivity" Digitalisation strategy for municipalities and counties 2017-2020	User-centric services and efficient public sector Digitalisation's contribution to growth and employment (value creation) Digital competence and inclusion Information security	The Association of Local and Regional Authorities have encouraged (2013-2016) municipalities and regions to formulate digital strategies individually or in collaboration. Regional or municipal digital agendas contribute to national goal setting.
Sweden	Digital Agenda "For a sustainable digitalized Sweden" Digital Agenda, "ICT for everyone" (2011) National digitalization(/digitization) strategy for schools (19/10-17)	Digital skills Digital security Digital innovation Digital management Digital infrastructure	Each region has their own digital agenda drawing from the 2011 National Digital Agenda. Regional agendas' biggest priority areas lay in infrastructure and e-services.

2.2.1 Denmark

Priority areas

- Digital solutions must be easy-to-use, quick and ensure high quality
- Digitisation must provide good conditions for growth
- Security and confidence must be in focus at all times

Key policies/strategies

- **Digital Strategy 2016-2020 “A Stronger and More Secure Digital Denmark” (2016)** – sets the course for Danish public sector digitisation efforts and their interaction with businesses and industry, contains 33 initiatives
- Redegørelse om Danmarks Digitale Vækst 2017 (2017) – preparatory document for upcoming Strategy for Digital Growth (2017)
- Strategy for Digital Welfare 2013-2020 “Empowerment, Flexibility and Efficiency” – accelerates the use of ICT and welfare technology in frontline public service delivery

Key actors (steering groups/committees)

- The Agency for Digitisation (Digitaliseringsstyrelsen), 2011 – responsible for the implementation of the Government’s digital goals
- The Council for IT projects – manages major government IT projects
- A project portfolio steering committee, (year) – ensures coordination and adaptation of the Digital Strategy 2016-2020 and makes sure that central, regional and local governments realize their goals

Regional Approach

The Digital Strategy 2016-2020 is a joint strategy created collaboratively by the Government, local government and Danish regions and thus binds all levels of public administration. There are also joint municipal and regional digital strategies, for instance sector-specific strategies (Digitaliseringsstyrelsen n.d.). Further, Danish regions have drawn up a paper of recommendations for Denmark’s digital growth to help solve the challenges of digital transition, especially in the healthcare sector (Danske Regioner 2017).

Examples from Denmark

Vejle

Vejle’s goal is to be a Resilient Smart City that “embraces new technologies and improves co-creation, efficiency, outreach and inclusivity” (Vejle’s Resilience Strategy 2016). To achieve this goal, Vejle supports the use of smart technologies, youth education in digital technologies and facilitates public access to open data. Vejle as the digital provincial city in Denmark has planned 20 smart initiatives, some of them already on-going. These include, for example, a FABLab where students can get an insight on the jobs of the future and become digital problem solvers, and a project of “digital inclusion” to “provide citizens, youth and elderly people, with the necessary support to keep up to date with digital technologies”. Moreover, Vejle is a testbed for innovative rural mobility solutions that are based on digital technologies.

Learn more: https://www.vejle.dk/media/4823/vejles_resilience_strategy_webquality_160316.pdf

Region Midtjylland

Region Midtjylland wants to be a digital pioneer and give the region's businesses the best conditions for using digitalisation as a platform to develop unique products and services with international outlets. The digitalisation effort Growth Forum (a platform for regional development) aims to support increased IT innovation and promote the use of IT and digital solutions throughout central Jutland businesses, which will create new global business opportunities for the region's SMEs.

Learn more: <http://www.rm.dk/om-os/english/regional-development/the-growth-forum/>

North Jutland Region

The regional transport authority runs several inspirational mobility projects. One of them is an APP that links public transport with other private transport options (carpooling, shared cars, ferries, taxis) which guides the user to the most convenient or cheapest traffic solution. The aim is to improve mobility in the outermost regions where public transport is not well accessible.

Learn more: <http://politiken.dk/indland/art6093502/Nordjylland-f%C3%A5r-smart-en-udvidet-version-af-Rejseplanen>

2.2.2 Finland

Priority areas

- Digitalised public services – public services will be user-responsive and primarily digital in order to achieve a productivity leap in public administration
- Establishing a growth environment for digital business operations – creation of a favourable operating environment for digital services and new business models (with a special focus on big data and robotization); information security

Key policies/strategies

- **Finnish Government Programme (2015)** - Overarching document guiding all activities of the Finnish Government from 2015-2020 with five strategic priorities one being “digitalisation, experimentation and deregulation”
- Digital Agenda 2011-2020: “Productive and inventive Finland” – “details the steps and actions required to update the National Information Society Strategy 2007–2015, and encourages different sectors to formulate digital strategies”; however, does not serve as an action plan

Key actors (steering groups/committees etc.)

- JulkICT (public sector ICT department) – responsible for the overall development of digital services of public administration and the integration of joint development projects
- DigiNYT (monitoring group) – monitors and coordinates (the implementation of) public sector projects related to digitalisation and automation following Government Programme’s objectives in digitalisation
- Tekes - Oversees R&D and innovation programs relating to Digitalisation

Regional approach

There is no push for regional digitalisation agendas from the national level. However, some regions have introduced their own digital agendas (e.g. Lapland 2013) supporting e.g. broadband coverage and digital skills development. In addition, digital programmes are drawn up and implemented on the municipal level (e.g. Helsinki, Tampere).

On a national level, regional effects are taken into consideration, for instance, by “Smart Countryside”-project. The project’s aim is, among other things, to support living and entrepreneurship in rural areas through digitalisation and experimentation.

Examples from Finland

Tampere

Tampere is the third biggest city in Finland with 228 000 inhabitants. Tampere is known for the ICT expertise in the region, and Tampere’s growth agreement with the state defines city’s focus area to be digitalisation. Tampere’s digital programme Smart Tampere (2017-2021) has two missions: 1) to digitalise municipalities’ services so that in 2025 services would be primarily digital and 2) to develop an overall smart city with digitalisation as a driving force.

Digitalisation in practice realizes in pilot projects. Examples include a pilot project where people’s movement was being tracked for a week using mobile network data and crowd analysis (in collaboration with Telia); development of the digital schools of the future (in collaboration with Microsoft); and use of big data for map and GIS services.

Learn more: <http://smart tampere.fi/smart-ecosystem-themes>

Espoo

Espoo is the second largest and the fastest growing city of Finland. Part of the Helsinki metropolitan area. Co-creating and collaboration with universities, companies and residents is the key element of their approach. Espoo Innovation Garden aims is to bring together the various partners operating in the area and to encourage their collaboration and sense of community. It functions as a test bed for new solutions rising from the knowledge and cooperation of various operators. The goal is to offer the inhabitants and those operating in Espoo better services and opportunities for operation through new technology.

Learn more: <http://digitallytransformyourregion.eu/case-studies/espoo/>

Oulu

City of Oulu, in partnership with Estonia and Sofia (Bulgaria) will coordinate the EU Urban Agenda, digital transition partnership. Sixteen partners (states, cities EU organisations) will analyse the topics of Future Health and Social Care services and Future Learning & Skills Development; Digitalisation on the topics of eGovernment and Urban Planning; Analysing the possibilities that are becoming available by fostering 5G and other Key Enabling Technologies; and the creation of Digital Services (Open data, standardisation and interoperability).

Learn more: <https://www.oukapalvelut.fi/kehittamishankkeet/Hankekortti1.asp?ID=713> ; http://ec.europa.eu/regional_policy/en/newsroom/news/2017/01/01-12-2017-urban-agenda-for-the-eu-four-new-partnerships-on-the-economy-digital-transition-jobs-and-transport

2.2.3 Iceland

Priority areas

- Iceland 2020: Iceland to be in the top 10 nations on the e-government development index and e-participation Index measured by the United Nations
- National Cyber Security: sound internet culture and security in cyber space to support economic prosperity and development; preparedness to tackle cybercrime

- State and Municipal Policy on the Information Society 2013-2016: the development of smooth digital public services towards better efficiency, transparency and democracy; knowledge building in IT

Key policies/strategies

- Iceland 2020 – a general governmental policy statement sets Iceland’s digitalisation goals to lay in the sphere of e-participation and e-government
- Icelandic National Cyber Security Strategy 2015-2026 - addresses the protection of Icelandic infrastructure starting from knowledge development and skills in digital security
- Icelandic State and Municipal Policy on the Information Society 2013-2016 “E-Power expansion –create, connect, participate” – a joint policy by the state and the municipalities to address the goals of the public administration in the information society⁷

Key actors (steering groups/committees)

- No general eGovernment or digitization agency (Nordic Innovation 2015)
- Ministry of Transport and Local Government – in charge of information society issues
- Information Society Taskforce – coordinates central eGovernment projects, operates under the auspices of the Ministry of the Interior (Transport and Local Government)
- Registers Iceland - operates most of the relevant common eGovernment solutions and operational measures
- Cyber Security Council - supervises the implementation of the National Cyber Security Strategy

Regional Approach

Implementation of actions related to the digital transition is highly decentralized in Iceland (European Commission 2016). “The policymaking and implementation is conducted in cooperation between the ministries and the Association of Local Authorities” (European Commission 2015). The Vision 2020’s guideline for regional actions is that the regional action plans shall take into account “the boosting of electronic services and restructuring of public services in each region”.

Example from Iceland

Reykjavik

Reykjavik provides several examples of what can be called mobile governance and e-democracy, promoting more open, transparent, innovative and participatory governments. The projects *Betri Reykjavik* (Better Reykjavik) and *Betri hverfi* (Better neighbourhood) were launched in 2011, aiming to increase further local citizens’ influence and participation in local planning and decision making (Tunström et al. 2016).

Reykjavik Smart City project gathers and combines data from different databases related to the infrastructure of the city. The data is used to improve services (e.g. transportation), quality of life and energy efficiency.

Learn more: <https://betrireykjavik.is/> and http://nyskopunarvefur.is/betri_reykjavik and <http://reykjavik.is/en/reykjavik-smart-city>

⁷ (1) Knowledge, (2) Accessibility and transparency (3) Coordinated structures and synergies between municipalities and state: (4) Reducing expenditure, (5) Democracy and (6) Services – immediate and always available.

2.2.4 Norway

Priority areas

- ICT policy for a user-centric and efficient public administration
- ICT policy for value creation and inclusion
- Electronic communication for increased productivity and a simpler everyday life

Key policies/strategies

- **Digital Agenda for Norway: "ICT for an easier everyday life and increased productivity" (2016)** – presents the Government's overall policy for how Norway can utilize ICT for society's best interest
- Digitalisation strategy for municipalities and counties 2017-2020 (Digitaliseringsstrategi 2017-2020) by the Norwegian Association of Local and Regional Authorities (2017) – a strategy targeted to local and regional public officials and politicians on how the work on digitalisation is to be continued

Key actors (steering groups/committees)

- Digitalisation Council, 2016 – helps government agencies in all phases of their digitization projects, ensuring that projects run on time and that their scope is in line with their budget.
- The Agency for Public Management and eGovernment (Difi), 2008 - coordinates between municipalities, government agencies) and the state in the digitalisation work
- The Norwegian Association of Local and Regional Authorities – coordinates between municipalities and the state in the digitalisation work

Regional Approach

Norwegian Association of Local and Regional Authorities (KS) is a key coordinator between municipalities and the government, and specific agreements are made between these actors (e.g. on guidance services for citizens) as most public-sector services are municipal (ref). KS has its own digitalisation strategy (2017-2020) where it reflects on the priorities set by the national digital agenda (2016). It also has an advisory committee on digitalisation (KOMMit). (However, the government will prepare a general overview of important orders and recommendations concerning digitisation in the municipal sector.)

KS has encouraged municipalities and regions to formulate digital strategies individually or in collaboration (Digitaliseringsstrategi 2013–2016 for kommuner og fylkeskommuner), and current regional and municipal digital strategies base on this KS strategy and previous national guidelines.

Example from Norway

Gausdal Kommune, Lillehammer Kommune, Oyer Kommune, Norway

The joint strategy for digitalization for the years 2017-2020 by the municipalities of Gausdal, Lillehammer and Oyer aims at "ICT friendly region" through resource efficient, digital public services. The solutions entail innovative procurement, cloud-based IT solutions, automation, and a focus on information security. Other objectives in the strategy are increased digital participation among citizens and citizen engagement in the service development. The drivers for digitizing the services are the future demographic challenges straining the public service system, citizens' and businesses' expectations of/for digital services and the objectives set in the national digital agenda (2016). A regional ICT Board has the overall responsibility of the municipalities' digitalisation. The municipalities of Gausdal, Lillehammer and Oyer have had formalised cooperation in ICT since 2003.

Learn more:

<https://www.gausdal.kommune.no/getfile.php/3811439.1852.qwurtsexe/Digitaliseringsstrategi.pdf>

2.2.5 Sweden

Priority areas

- **Digital Skills:** everyone should be familiar with digital tools and services in order to participate in the digital development
- **Digital security:** people, companies and organizations should trust and be comfortable with the use of digital services
- **Digital innovation:** the conditions for new or better solutions that provide value for the environment, society, companies, and individuals are created and spread
- **Digital management:** operations should be streamlined, developed and improved through control, measurement and follow-up
- **Digital Infrastructure:** the importance of the so-called hard and soft infrastructure being enhanced to allow data to be transported as efficiently as possible

Key policies/strategies

- **Digital Agenda for Sweden “For a sustainable digitalized Sweden” (2017)** - outlines how digitalisation policy is going to contribute to competitiveness, full employment, and economic, social and environmentally sustainable development
- National Programme Digitalt Först (2015-2018) – a programme to renew the public sector with a focus on IT and e-governance
- National digitalisation(/digitization) strategy for schools (19/10-17) – explains how the school system can contribute to the modernization of Sweden with the goal of high digital competence, knowledge development and equity.⁸
- Digital Agenda for Sweden “ICT for everyone” (2011) - collated ongoing activities in a cohesive strategy in order to use the full potential of digitization, and worked as a point of departure for the creation of regional agendas

Key actors (steering groups/committees)

- Digitization authority, 2018 - will coordinate and support the overall digitization in the public sector
- Digitalisation Council, 2017 – promotes the implementation of the government’s digitization policy and coordinates between different governmental and public organisations and subject areas and reaches also out to private actors
- Swedish Association of Local Authorities and Regions (SKL) – takes care that strategies are turned into initiatives and actions, a role e.g. in the education field and e-health

Regional approach

In connection with the presentation of the National Digital Agenda (2011), regional actors were invited to sign a voluntary letter of intent to show that they share the goals of the Agenda and that they will draw up a regional digital agenda. All 21 counties have signed the letter of intent (ref). Infrastructure and e-services are the biggest priority areas in regional agendas (ref). The Digital

⁸ <http://www.regeringen.se/4a9d9a/contentassets/oob3d9118b0144f6bb95302f3e08d11c/nationell-digitaliseringsstrategi-for-skolasendet.pdf>

Agenda (2017) voices the need to promote not only smart cities but also sustainable rural areas through digitalisation/digitisation).

Examples from Sweden

Norrbottnen

Norrbottnen's approach to digitalisation is focused making everyday life easier through solutions that enable people to work, learn and communicate from distance. Norrbotten is a "hotbed of solutions that bridge distances, and the region makes use of this position in e-health development" (Luleå University of Technology 2012/5). One of the region's priorities is to invest in research and development in e-health. Norrbotten has been awarded a prize by European Commission for region's work within e-health.

Learn more:

<https://www.ltu.se/centres/eic/Om-oss/Norrbottnen-en-innovativ-IKT-region?l=en>;
<http://www.norrbottnen.se/publika/lg/verk/Kansli/Lst/2016/Bilagor/Fortsatt%20utveckling%20av%20vård%20opå%20distans%20slutgiltig.pdf>

Helsingborg (Skåne)

In its vision for 2025, Helsingborg has set a common target for the city that digitalisation should offer a coherent, flexible and individual service to every citizen. Helsingborg also wants to create a co-operative arena where individuals, organisations and companies can to develop services and values for the citizens. Helsingborg has chosen five focus areas until 2025 to fulfil the vision.

Learn more: <https://digitalisering.helsingborg.se/digitalisering-i-helsingborg-5-fokusomraden/>

Värmland

The Värmland region in Sweden has selected digitalization of welfare services as one of the focus areas of its regional smart specialization strategy. The vision of the smart specialization in the field of digitalization of welfare services is a welfare sector for co-creating citizens with a well-developed and safe IT environment as a base where the focus is on the human aspect, and the individual's benefit from new value-creating processes. Värmland is developing and testing welfare services in actual environments with users: women, men, girls and boys as co-creators to provide varying types of solutions, many of which are digital. The public sector is an important user and procurer of these processes. This results in better and more effective care, education and other social services and ultimately happier, more competent and healthier citizens.

Learn more: <http://www.regionvarmland.se/wp-content/uploads/2016/02/VRIS3.pdf>

2.2.6 Greenland, Faroe Islands and Åland

The Ministry of Industry and Foreign Affairs of the Faroe Islands has launched a project "Talgildu Føroyar" (Digitalised Faroe Islands) running 2015-2020. The main focus of the project is on the modernization and digitalisation of the welfare and public services. The strategy document on digitalisation was developed as an outcome of the WG project "Digital Faroe Islands" that addresses four main themes: digital services, digital ID, Safe Data Transfers for all, and Authorities and Structure.

The Government of Åland has established a Digital Council in 2016 to modernise ålandic society within the field of IT and to develop digital solutions that stem from citizens' needs. In 2017, the Digital Council presented its digital vision "Åland 2.0 Simpler and Safer". The Action Plan includes

e.g. following themes: an establishment of a digitalization forum for collaborative work between the public, private and the third sector, taking part in digitalization projects and following the digitalization work in neighbouring countries, legislation's role in driving the change and developing citizens' digital skills.

Greenland has a number of ongoing initiatives with the aim to foster digitalization, such as a project on 'grunddata' (basic data) for Greenland and updating the national webGIS system called NunaGIS. Moreover, there are important efforts on the infrastructure improvements, including connecting fiber optic cables to the global network. Within a few months it will result in more than 75 % of the households in Greenland having access to high speed internet access. In 2013, a Digitisation Agency was established in Greenland that focuses on digitalizing the public sector.

2.3 Nordic cooperation on digitalization

Nordic Innovation received funding under the Nordic Cooperation Programme for Innovation and Business Policy 2014-2017 for a number of lighthouse projects, one of which is titled Innovative Nordic Digital Solutions. This project will contribute to the ambitious goal of making the Nordic Region a digital pioneer and includes three tracks:

- Track 1: Nordic eID was led by the Norwegian Directorate for Administration and ICT and has documented similarities and differences between the electronic identity (eID) systems in Denmark, Finland, Iceland, Norway and Sweden with the overall aim of promoting cross-border cooperation on eID (for full report see: Hansteen et al 2016).
- Track 2: Nordic SmartGovernment is led by the Danish Business Authority and seeks to develop a new digital infrastructure that will streamline interactions between business and government through the automated exchange of business data (for more details visit: <https://nordicsmartgovernment.org>)
- Track 3: Data driven innovation is led by Nordic Innovation and includes the Hack4Norden challenge which aims to support the development of companies that use data in new and innovative ways (for more information see: Nordic Innovation 2016).

The project also resulted in the comprehensive report: The Nordic Digital Ecosystem: Actors, Strategies, Opportunities. The research found that, while the Nordic countries share common goals, they are working in quite different ways to achieve these goals (van Marion & Honerud Hovland 2015). As such, the authors suggest that bilateral or trilateral cooperation may be a more fruitful starting point for cooperation (van Marion & Honerud Hovland 2015). The vast majority (80%) of respondents to the survey informing the report said that their organisation is involved in Nordic collaboration of some kind but even more (90%) believe potential exists for future cooperation. Interestingly, despite all five Nordic countries reporting working on, or planning to begin work on, a digital strategy, none had plans to include a Nordic agenda in these strategies (van Marion & Honerud Hovland 2015). Finding a common platform from which to negotiate in the EU arena was noted as a particular priority for collaboration work.

The bilateral cooperation recommended in the report is already evidenced at a regional scale through cross-border cooperation, which forms a vital part of Nordic cooperation. By way of exploring digitalisation in the context of cross-border cooperation, Nordregio will collaborate with Svinesundskommittén (a Swedish-Norwegian cross-border organisation) and a Norwegian research partner to conduct a cross-border study around the theme of digitalisation as a tool for blue and sustainable Nordic regional development. This case will be included in the Nordregio in-depth study and will also inform a stand-alone report.

Other relevant reports taking a pan-Nordic perspective include:

- *Digitalisation and automation in the Nordic manufacturing sector – Status potentials and barriers* (Iris Group 2015). This report provides an overview of the Nordic manufacturing sectors, highlighting their similarities and differences and looking into the status and potentials for digitalisation from both a business and a political perspective.
- *Nordic labour markets and the sharing economy – Report from a pilot project* (Dølvik & Jesnes 2017). This report was funded by the Labour Market Committee of the Nordic Council of Ministers and is based on background reports prepared by experts in each of the five Nordic countries. Its aim was to develop a knowledge base through which to consider the potential impact of the sharing economy on Nordic labour markets with a view to developing future Nordic studies.
- *Catching up with society – A digital reality check for Nordic NGOs* (Accenture 2017). This report examines the digital readiness of 60 NGOs (15 each from Denmark, Finland, Norway and Sweden) based on a Digital Performance Index, interviews with stakeholders that aimed to tap into their unmet needs, and a creative workshop with Nordic NGOs to innovate new services. The findings set out a roadmap for NGOs to catch up and thrive through the use of digital technologies.

Several upcoming initiatives related to digitalisation have also been announced under the Swedish Presidency of the Nordic Council of Ministers in 2018 (Nordic Council of Ministers 2017).

3 Conclusions and next steps

Digitalisation is a broad concept with far-reaching consequences for all levels of government, business and society. Regional policy making in this field is in its infancy and specific approaches appear to be broad in nature, as well as differing based on the specific characteristic of countries and regions. There is much to be learned about the specific ways in which regional actors are responding to the challenges highlighted above, as well as the interaction between policies and actors at the different levels of governance. As such, it is recommended that this project take a broad approach, exploring digitalisation as a tool for sustainable Nordic regional development with respect to social, economic and environmental aspects as well as considering governance implications. The research questions initially presented in the project proposal have been refined based on the findings of this report and subsequent feedback from the TG2. They are as follows:

1. What are the priorities / focus areas of digitalisation strategies in the Nordic countries?
2. What are the priorities / focus areas of regions with respect to digitalisation? How are these related to and / or supported by national, Nordic and EU agendas?
3. How are regions dealing with the challenges and opportunities related to digitalisation? (particularly with respect to the green transition and labour market impacts)
4. Where are the strongest potentials for knowledge-sharing / collaboration between Nordic regions?

The next step for the project will be to identify case-study regions in each of the Nordic countries. The feedback from TG2 on this report suggested a need for a focused approach to the case studies that will deliver substantive findings and offer more than stand-alone examples of best-practice. In line with this suggestion, further desk-top research will be undertaken into the examples provided in this discussion paper prior to making the final selection. The set of criteria that will be used to make the final selection is as follows:

1. **Regional characteristics:** The case study areas should represent different regional typologies⁹
2. **Evidence of a regional approach:** All cases will demonstrate some evidence of a regional approach to digitalisation. Given the nature of the topic under investigation, this regional approach may not be neatly confined to the NUTS 3 level. What is vital however is that digitalisation is addressed beyond the "smart city".
3. **Digitalisation focus:** The full suite of case studies should allow us to highlight a diverse range of practices within the context of digitalisation as a tool for sustainable Nordic regional development. Care should be taken to highlight the social, economic and environmental aspects of sustainability in the project overall.

Empirical data will be gathered through a combination of the following methods:

- *Desktop research* may include documents such as digital strategies, case studies and other types of research relevant to the case study regions, and data related to the performance of the region on digital indicators. Desktop research will precede interviews but may also occur following interviews in the event that documents not previously accessed are made available by interviewees.
- *Semi-structured stakeholder interviews* will be held during several field trips to the chosen Nordic regions. The stake-holders selected may vary based on the region but could be

⁹ Classification based on State of the Nordic Region, 2018.

expected to include: 1 "local champion" (may be an academic, TG2 member or other local person who is a key player on the issue); 1-2 representatives of the regional authority; 1-2 representatives of municipal authorities within the region; 1 representative of a research institute or university; 1-2 representatives from the private sector (e.g. cluster organisations, technology company) and 1 representatives from the not-for-profit sector. This will result in 6-8 interviews for each case. Interview schedules for each target group will be developed in line with the project proposal.

- *Charts and maps* will be developed by Nordregio's GIS team. Investigation is currently underway about the possibility of creating a map of "vulnerability to labour market automation".

A pilot case will be undertaken in February-March 2018 and adjustments to the methodology will be made according to learnings. The remainder of the field work will be conducted from March-August and the final report will be released in late 2018.

DISCUSSION PAPER

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Appendix I. Digital technologies with high transformative potential

The table below has been developed based on a report from the McKinsey Global Institute (Manyika et al 2013), which highlights the 12 technologies with the greatest transformative power on a global scale by 2025. 'Transformative power' is defined as those that will be the most likely to have a significant impact on the way people live and work and on industries and economies (Manyika et al 2013). This is by no means an exhaustive list but covers the technologies likely to have the most impact in the short to medium term. In many cases, the innovations with the greatest transformative potential rely on the interaction of these technologies. For example, 'big data', a commonly cited e-governance tool, relies on mobile connectivity and the internet of things for the collection of data, cloud technologies for its storage and, in some cases, artificial intelligence / machine learning / advanced robotics to act on the information gathered.

Summary of technologies enabling the digital revolution (developed based on Manyika et al, 2013)

Technology	What is it?	Transformative qualities / implications	Application examples
Mobile internet	Increasingly inexpensive and capable mobile computing devices and internet connectivity	Connectivity is increasingly integrated in everything we do, blurring the boundaries between human and technology and fundamentally changing the way we interact with the physical world	wearable smart phones; health and wellness applications; mobility solutions.
Artificial intelligence (AI) / machine learning	Intelligent software systems that can perform knowledge work tasks involving unstructured commands and subtle judgments	Potential for automation of knowledge economy jobs	
Internet of things (IoT)	Physical objects (e.g. park bench, lights) are connected by networks of low-cost sensors that allow them to collect data and monitor environments	Allows for the collection of data on human behaviour and environments at an unprecedented scale. Potential for increased resource efficiency and data based decision making. Privacy questions?	'Smart' cities, offices, homes, agriculture, etc. resource efficiency, food production, etc.
Cloud technologies	Supports other functions by making the digital world simpler, faster and more powerful using computer hardware and software resources delivered over a network or the internet	Makes previously complex and expensive IT systems readily available (particularly useful for SMEs). Raises legal issues around the storage of sensitive information	Low-cost, user-friendly storage of large amounts of data through platforms like Dropbox, Google Drive, OneDrive, etc.
Advanced robotics	Increasingly capable robots with enhanced senses, dexterity, and intelligence used to automate tasks or augment humans	Further automation of manufacturing jobs.	Robots take on jobs requiring high levels of precision (e.g. surgery)

Autonomous and near autonomous vehicles	Vehicles that can navigate and operate with reduced or no human intervention	Potential to completely transform ground transportation with implications for urban design (e.g. parking, pedestrian vehicle interface) as well as service delivery in rural areas.	
Next-generation genomics	Fast, low-cost gene sequencing ¹⁰ , advanced big data analytics, and synthetic biology ("writing" DNA)	Potential for medical advances that could dramatically increase the quality and length of life.	Can be used in agriculture to produce high value materials (e.g. biofuels).
3D printing	Additive manufacturing techniques to create objects by printing layers of material based on digital models	Potential disruption to manufacture / supply chains. Medical advances (e.g. printing organs). Legal implications around importation of goods (e.g. printing weapons)	
Advanced materials	Materials designed to have superior characteristics (e.g., strength, weight, conductivity) or functionality	Still in R&D stage – implications unclear	
Advanced oil and gas exploration recovery	Exploration and recovery techniques that make extraction of unconventional oil and gas economical	Potential to hamper global efforts on renewable energy by increasing the availability of fossil fuels. Substantial environmental risks	
Renewable energy	Generation of electricity from renewable sources with reduced harmful climate impact	Increased cost effectiveness and performance of existing solutions along with development of new solutions	

¹⁰ Human genome sequencing took 13 years and cost \$2.7 billion to accomplish under the Human Genome Project. Now it can be done in under 3 hours for \$3,000.

Appendix II. Resources for policy review

European Union¹¹

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¹¹ Please note that this is by no means intended to be a complete review of European policy on digitalisation.

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