



Nordic Broadband City Index

How cities facilitate a digital future

October 2014



Title *Nordic Broadband City Index*
Date and version *October 2014 – Version 1.3*

About this report

The Nordic Broadband City Index (“NBCI”) has been prepared by Jan Morten Ruud, Mikael Christiansson, Marit Wetterhus and Harald Wium Lie at Nexia DA on behalf of Telenor ASA in the period from August to October 2014.

Special thanks to

We would not have been able to obtain information on the Swedish market if it was not for generous help from Skanova, where Andreas Tornvall and his colleagues helped us with vital information. Tele2 also helped out and we also want to thank several employees at Eltel Networks.

In Denmark, Rikke Austin Josephsen at TT-Netværket P/S and Peder Hansen at Telcon were of invaluable help, and we would also like to thank Anders Poulsen at Global Connect and Jakob Willer at Teleindustrien.

In Norway, we would like to thank Per Frantzen, Kjetil Wiig, Kai Inge Nordal and Arild Josten at Eltelnetworks; Robert Pettersen, Eric Sjøby, Per Jørgensen, Sverre Lysnes, Tom Svinkerød, Snorre Gaasland, Morten Skjelbred, Mathias Johnsen, Tore Berglund and Øystein Johansen at Sønnico; and Tom Bakke Pedersen, Øystein Knudsen, Kari Engeseth, Stein Tellef Tellefsen and Erik Sikkeland in Relacom. They provided us with valuable information we needed in order to develop the NBCI, and we are very grateful that they all took time out of their busy schedules to talk to us.

We would also like to thank all the municipalities for their time and efforts, Line Richardsen in Kommunenes Sentralforbund (KS), Kirsti Kierulf in KommIT, Heidi Austlid at IKT-Norge, Frode Danielsen at difi in Norway and last, but not least the people in Telenor Denmark, Telenor Norway and Telenor Sweden for their support and expert knowledge.

About Nexia DA

Nexia DA is a management consultancy with expertise in telecommunications, ICT infrastructure and technology. Nexia DA provides expertise in business analysis, strategy development, business development and management to the telecommunications, ICT infrastructure and technology sector.

Disclaimer

Information and opinions contained in this publication is provided by the authors and by Nexia DA, and does not necessarily represent the opinions of Telenor ASA. This report is based on information from Telenor, publicly available information and information from sources deemed to be reliable. We have not been able to verify the information in many cases, and cannot guarantee for the correctness of the information. All rights are reserved.

Content

1	EXECUTIVE SUMMARY	4
2	METHODOLOGY	8
2.1	What we did	8
2.2	Data collection	9
2.2.1	Municipal web sites and general web searches	10
2.2.2	Network building contractors and consultancies.....	10
2.2.3	Expert Interviews	10
2.2.4	Telenor site analysis	11
3	COUNTRY-LEVEL FINDINGS	12
3.1	Introduction	12
3.2	Main findings.....	13
3.3	Variations between (and within) municipalities	15
4	DIGITAL SERVICES: A MARKED IMPROVEMENT	17
4.1	Main findings – digital services	17
4.2	Background for choosing services in the Index	18
4.3	Variables and weights	19
4.3.1	ICT strategy	20
4.3.2	Online daycare application.....	21
4.3.3	Online building permits	21
4.3.4	“Fix-My-Street”	21
4.3.5	Digital invoicing	22
4.3.6	Secure communication.....	22
4.3.7	Welfare technology (e-health)	22
5	MOBILE NETWORK DEPLOYMENT: A MATTER OF CONCERN.....	25
5.1	Main findings: mobile network deployment	25
5.2	Variables and weights	27
5.2.1	Access.....	27
5.2.2	Lease cost	27
5.2.3	Overall impression, collaboration and effectiveness	28
5.2.4	Mobile master plan	29
6	FIXED NETWORK FACILITATION: GENERALLY DIFFICULT	30
6.1	Main findings for fixed network facilitation	30
6.2	Variables and weights	31
6.2.1	Flexible use.....	31
6.2.2	Fair pricing/costs	32
6.2.3	Operator neutrality	33
6.2.4	Role in network deployment and operations.....	34
	APPENDIX A: THE NORDIC BROADBAND CITY INDEX 2014.....	35
	APPENDIX B: SCORE PROGRESSION 2012 - 2014	37
	APPENDIX C: QUESTIONS TO CONSTRUCTION COMPANIES	38

1 Executive summary

Introduction

This study is dedicated to gaining insight into how Scandinavian cities facilitate mobile and fixed network deployments and to what extent they offer digital services to their inhabitants.

Even if European telecom operators are subject to a number of Europe-wide and national regulations, telecom is primarily a local business. Few national regulators issue trenching permits, and access to buildings for mobile antennas is usually granted by the owner of the building. Several studies have found that infrastructure costs (such as digging and mobile masts) are the most important cost element when rolling out a network. In other words: local rules and regulations have an important impact on network operators' ability to roll out networks and services in a timely and cost-effective manner. And while national and EU-wide regulations are normally well defined, well known and consistently applied, municipal regulations and conditions vary widely.

The demand for fixed and mobile capacity is growing rapidly. This is good news: the evidence is fairly conclusive that increased use of high-speed networks drives economic growth¹. However, the price and coverage of high-speed mobile and fixed networks will depend to a large extent on network deployment costs.

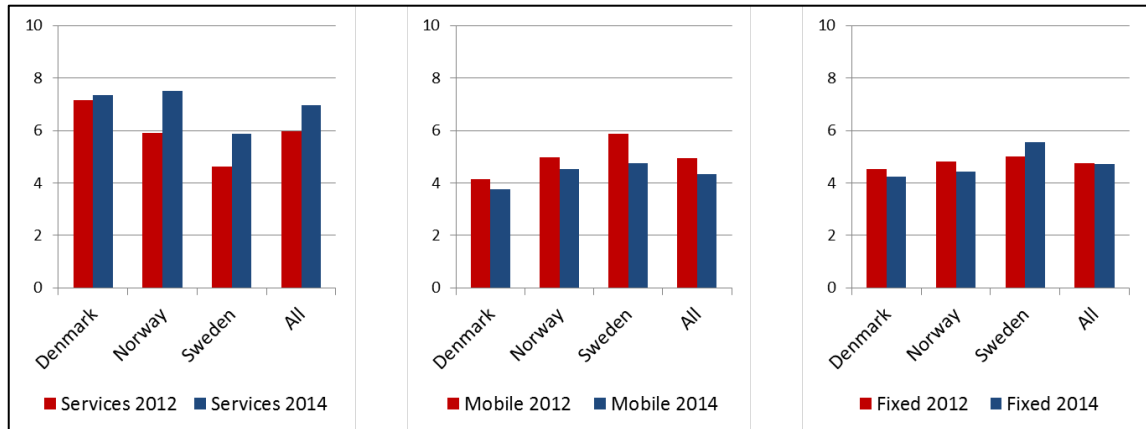
Also, municipalities have become an important provider of online services. Since such services drive both productivity gains and network usage it is important to understand to what extent municipalities offer such services to their inhabitants. The aim is to identify good practice, innovative solutions, and local facilitation of digital services that meets societal needs and interests. Good broadband cities facilitate digitalization with an open and holistic strategy that takes full account of citizens' needs. This does not only involve modernizing city websites and services, it also depends on fixed and mobile networks so that citizens can access those services.

When planning the study, we sat down with experienced service developers and network managers at Telenor in Norway, Sweden and Denmark. The agenda was quite simple: If a municipality wants to facilitate network deployments and offer high-quality online services, what should that municipality do? When the most important variables were identified, we attached weights and grades to them in order to build the framework for The Nordic Broadband City Index. Also, we made a «gold standard» for each variable that every municipality was measured against. In total, the Index consists of 23 variables across three categories.

Main findings

Although the Nordic countries have some of the world's best broadband networks and public digital services, there is a significant upside potential in how Nordic municipalities provide online services to inhabitants and facilitate mobile and fixed network deployments. The average score across all 43 municipalities and categories was 5.3 out of 10. This a slight increase compared to the 2012 study where the average score was 5.2.

¹ Katz, "The Impact of Broadband on the Economy: Research to Date and Policy Issues", ITU, 2011



Online public services: A marked improvement

The small change in average scores, however, hides important changes in category scores. We have seen a marked improvement in municipal online services, where the average score has increased from 6.0 in 2012 to 7.0 in this year's study.

In general, Nordic cities offer a broad range of digital services to their inhabitants. Almost all cities now support the services we looked at two years ago. Norway and Sweden show a strong improvement since 2012, primarily due to better scores in the areas of secure communication and digital invoicing.

Welfare technologies were added to this year's study. We found substantial variations among countries and municipalities. While most cities in Norway and Denmark are fairly prepared for the introduction of digital welfare technologies, many Swedish municipalities still have a way to go. In addition, many Danish cities have already implemented certain digital welfare services. This may explain the growing understanding of the importance of network infrastructure among municipalities in Denmark.

Mobile network deployment: A matter of concern

Compared to 2012, all countries receive a lower score for mobile network deployment, and the mobile area now has the lowest score of all areas. The most important driver for this is access to public grounds and buildings, which is increasingly becoming more difficult. This is especially concerning because many public services, and in particular welfare technologies, depend to a large extent on high area coverage and robust mobile networks with high uptime. Municipalities will have to play an important role in order to realize such networks. Today, too many cities fail to do so.

There are noticeable differences between the countries. In Sweden, almost 25 % of Telenor's mobile masts and antennas are placed on municipal property. In Norway and Denmark, the shares are 13 % and 19 % respectively. Also, Sweden has relatively low municipal lease costs compared to private sites. Denmark has by far the highest lease costs overall which is likely to impede future capacity and coverage growth.

Fixed infrastructure: Generally difficult

Better fixed networks are necessary in order to realize deployment of high-capacity mobile networks and new digital services. Although the 2014 scores are slightly higher than the 2012 results, it is disappointing to see that most Scandinavian cities have such a long way to go in

order to facilitate the rollout of fixed networks. Not surprisingly, digging and road modification cause local frustration and tension that cities need to manage and reduce, together with contractors and operators.

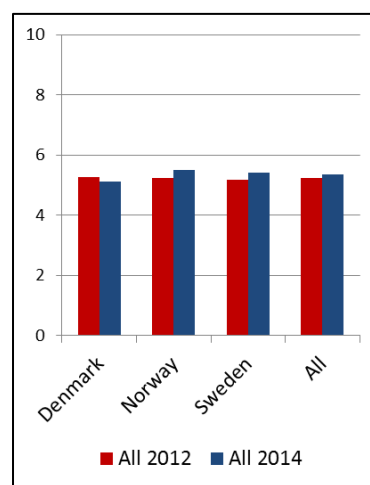
Swedish municipalities have the highest scores in the fixed network area. Compared to 2012, more Swedish municipalities allow for microtrenching which is an environmentally friendly, fast and cost-effective method for network deployment. Still, microtrenching is underutilized across all countries.

In addition, most municipalities have unnecessarily high depth requirements for traditional digging. Taken together this means that the cost of deploying fixed networks is much higher than what it could have been, and that many areas will remain commercially unattractive for high speed network deployments.

Sweden has a much higher level of public network deployment than Norway and Denmark. Several Swedish cities, e.g. Stockholm, allow affordable access to extensive fiber networks, which is clearly beneficial to network operators and their users. Other Swedish cities and public network owners, however, have implemented rules for pricing and access that are not operator-neutral.

Danish cities lose ground

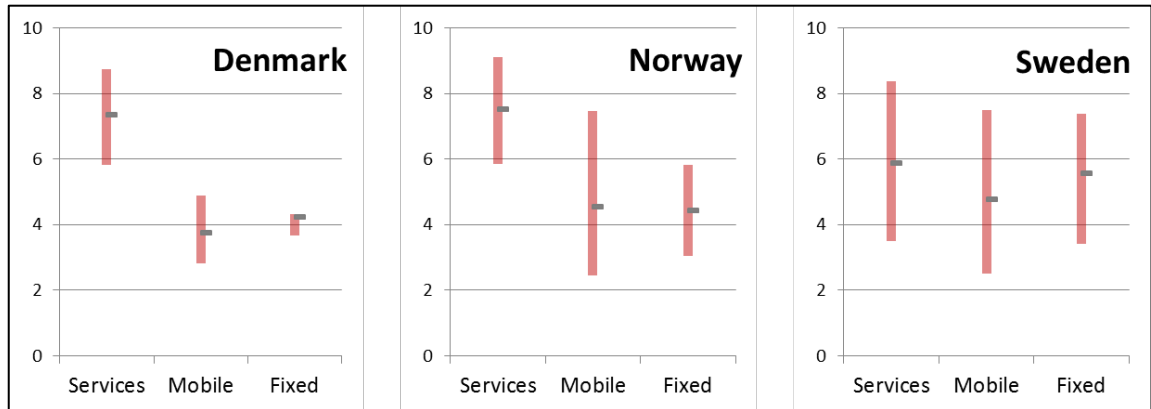
The average scores for Swedish and Norwegian cities have increased somewhat since 2012. The situation is different in Denmark: The scores for online services are up, but the increase is lower than in Sweden and Norway, and the scores for mobile and fixed network facilitation have decreased since 2012. While Denmark had the highest overall scores in 2012, the country has now been surpassed by both Sweden and Norway. The differences are not major, but the Danish trend is worrying. It is therefore important that the indications of higher infrastructure awareness in Denmark are translated into concrete and meaningful network facilitation policies.



In the mobile area, several factors drive decreased Danish scores: Application processes have become more cumbersome, the quality of mobile guidelines has decreased, and the lease cost level is still very high. Also, Denmark has more consistent rules for fixed network deployment than the other countries. Unfortunately, in our view, they are consistently bad.

Large variations between (and sometimes within) municipalities

As opposed to Denmark where national rules are the norm, scores vary widely between Swedish and Norwegian cities.



The figure above shows that Swedish municipalities have the greatest variation as far as services are concerned. Sweden has both one of the highest-scoring cities in digital services (Västerås, at 8.4) and the lowest-scoring city in that category. The same is true for Norway in the mobile network facilitation category: The city of Bodø scores 7.5 while two other Norwegian cities are at the bottom of that list.

The Swedish municipalities also show the greatest variation for fixed network deployment, while Danish cities in general follow national rules and policies for the facilitation of fixed networks.

In a few cases we also found variations within the same municipality where different officials interpret (the same) local rules in different ways. Such situations are more likely to be avoided by clear, transparent and quantified rules and regulations.

And the winner is....

We are in the middle of a digital revolution. The digitization of important value chains such as health care and transportation will mean that tomorrow's telecom networks will have to be robust and able to carry traffic growing at exponential rates. Also, they have to offer coverage practically everywhere. Municipalities who play a constructive role with regards to network facilitation can be more confident than others that the new, digital value chains will work across the city in a meaningful way.

In our view, none of the larger Nordic cities we studied have a consistent, strategic approach to the full scope of policies needed to fully realize their digital potential. But some have clearly set out on a new direction with a clear strategy for many aspects of digital facilitation. Some Swedish and Norwegian cities reveal a holistic understanding of digital needs and policy requirements. Some cities simply seem to be more ready for their digital future than others. Among them are the top three cities in this year's index: Linköping (SE), Västerås (SE), and Kristiansand (NO).

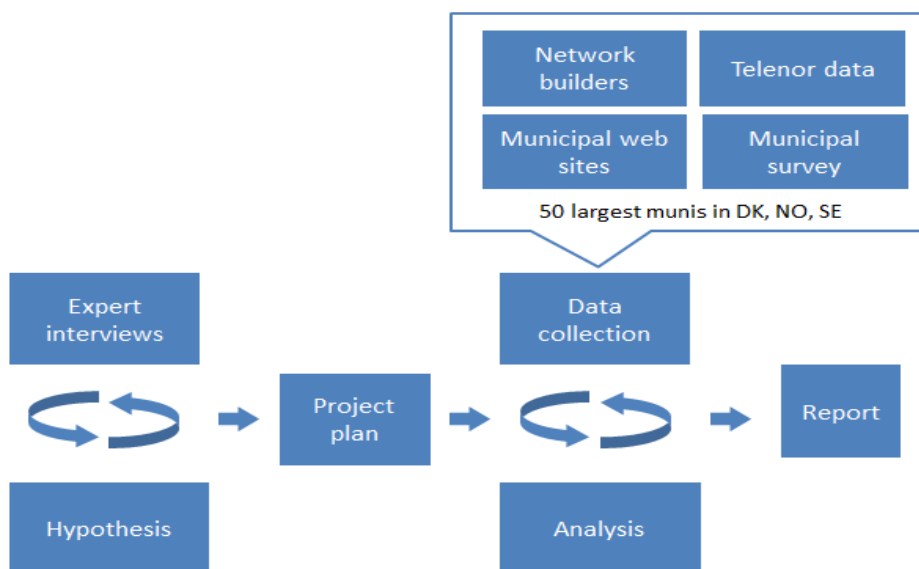
However, telecom and utility operators and engineers are not perfect, either. During the last twenty years, the number of broadband and telecom companies in the Nordic countries has skyrocketed, and not all of these companies are equally patient or compliant in rolling out infrastructure in an effective and responsible way. There have been local instances of poor road repair, over-investment and excessive street-digging. Tensions between cities on the one side, and cable and mobile operators on the other, have increased over the last twenty years. Both sides must bear responsibility for this trend, and find common solutions to improve effectiveness and balance societal needs in digital deployment.

2 Methodology

2.1 What we did

When planning the study, we sat down with experienced service developers and network managers at Telenor in Norway, Sweden and Denmark. The agenda was quite simple and similar to the 2012 study: If a municipality wants to facilitate network deployments and offer high-quality online services, what should that municipality do? The overall project plan is shown in Figure 1.

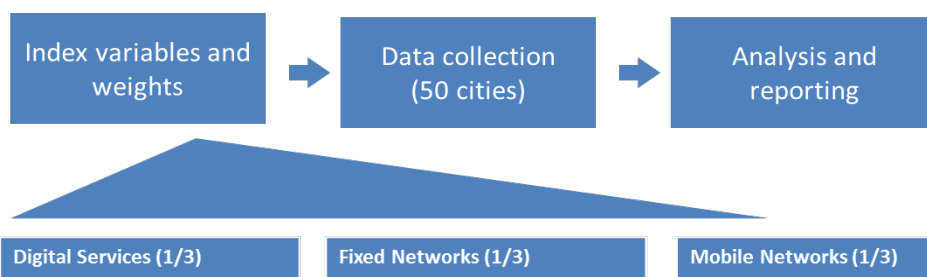
Figure 1 - Project plan



Source: Nexia DA

As in 2012, we split the Nordic Broadband City Index (NBCI) into three equal parts: municipal online services, mobile network deployment and fixed network deployment. Each category accounts for a third of the total NBCI. The difference between fixed and mobile infrastructure is diminishing as all networks are becoming fiber-based. Still, there are important differences between fixed and mobile networks, and we decided to differentiate between the two as shown in Figure 2.

Figure 2 - Methodology



Source: Nexia DA

The methodology was similar to the one used in the 2012 study with one exception: The digital Services area was expanded to include digital welfare services / e-health. We worked with experts at Telenor and Kommunenes Sentralforbund (KS) in Norway to identify the best variables in each category and we had the same criteria in mind when selecting variables as we did two years ago:

- Valid: Meaningfully represent the area that we wanted to understand
- Objective and measurable
 - Reliable
 - Preferably quantifiable
- Granular enough to identify real differences

Digital welfare services turned out to be a good differentiator between municipalities, since many of the online services we tested for in 2012 have now been adopted by a majority of the municipalities.

Once we had decided on the different variables, we made a “gold standard” for each variable. All municipalities were then measured against this standard and graded accordingly. The weights and variables for each category will be described in more detail later in the report.

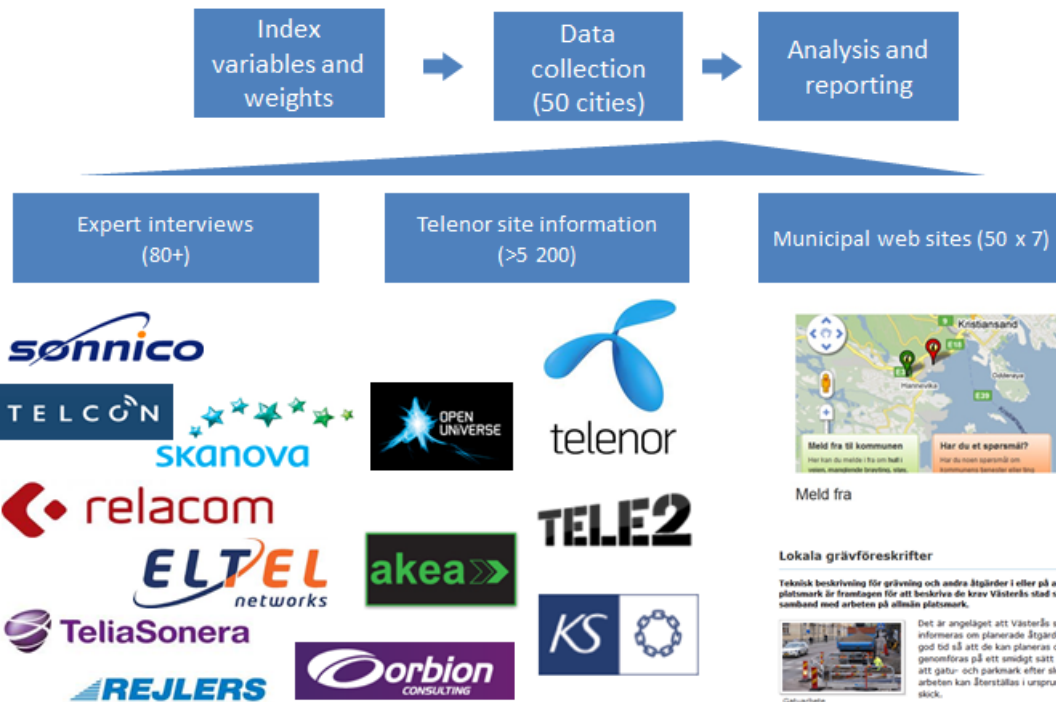
In order to make comparisons from two years ago, the municipalities in this study were also mostly the same as then and they were initially chosen based on size. The only changes that were made were the substitution of one municipality in Sweden (from Lund to Eskilstuna) due to data collection challenges, while two municipalities in Norway (Skien and Sarpsborg) replaced others due to changes in municipal population. In 2012, we selected the 50 largest municipalities in Denmark, Norway and Sweden, and gathered complete information from 43 of these. As such, this year’s NBCI is also based on a complete data set for 43 municipalities (15 in Denmark, 15 in Norway and 13 in Sweden²), representing approximately 35 % of the Scandinavian population. The municipalities and their scores are outlined in Appendix A and changes for the municipalities from 2012 to 2014 in Appendix B.

2.2 Data collection

We collected data from a number of sources, the most important being municipal web sites (for the service part), local contractors (for the network facilitation parts), and Skanova and Tele2 (for the network facilitation part in Sweden). In addition, we analyzed site information from Telenor Denmark (TT Networks), Telenor Norway and Telenor Sweden. TT Networks, who delivered data on behalf of Telenor Denmark, also gave us site data for TeliaSonera in Denmark which ensured a better sample size. The data was collected over a period of two months and from several sources, as can be seen from Figure 3 - Data sources.

² Some of the fixed information for Umeå is two years old.

Figure 3 - Data sources



Source: Nexia DA

2.2.1 Municipal web sites and general web searches

The municipal web sites were used extensively to collect data on the digital services offered by the municipalities. The web search was performed from the middle of August until the middle of October 2014.

2.2.2 Network building contractors and consultancies

We performed in-depth interviews with the telecom contractors and consultants to find out how it is to work with the respective municipalities in the NBCI. These contractors and consultants let us interview their employees who worked with the specific municipalities on a day-to-day basis.

Figure 4 - Network building contractors and consultancies

ELTel Networks	Relacom	Orbion Consulting	Telcon
Sønnico	Rejlers	Global Connect	Akea

2.2.3 Expert Interviews

We also interviewed local contractors and conducted additional interviews with experts who work directly with the municipalities. As in 2012, Skanova in Sweden contributed greatly to the study, giving us valuable input on the fixed network part. Tele2 and Telenor Sweden helped us with the mobile knowledge we needed for all the Swedish municipalities.

We also talked to experts at IKT Norge, Kommunenes Sentralforbund (the organization for municipalities in Norway), their daughter organization, KommlIT and Sveriges Kommuner och Landsting (SKL) in Sweden. Experts at Telenor Norway, Telenor Denmark and Telenor Sweden were also great contributors of information.

We also interviewed experts in all three countries who wished to remain anonymous for various reasons.

2.2.4 Telenor site analysis

We obtained the following site information for all the relevant municipalities from Telenor's Nordic operations (including also TeliaSonera's information in Denmark):

- Site type (property for masts or rooftop access)
- Site ownership (municipal, other public and private)
- Yearly site lease costs

3 Country-level findings

3.1 Introduction

The Scandinavian countries have some of the world's best broadband networks and public digital services. This is well documented in several studies, also in the United Nations E-Government readiness ranking that is published every second year. The Scandinavian countries ranking, in this study from 2008, show that the top three positions were occupied by Sweden (1st), Denmark (2nd) and Norway (3rd). However, in this year's ranking Norway came 13th, Sweden 14th and Denmark ended up 16th (see Figure 5 below).

Figure 5 - E-government development index

Ranking	2001	2003	2004	2005	2008	2010	2012	2014
1	US	US	US	US	Sweden	S Korea	S Korea	S Korea
2	Australia	Sweden	Denmark	Denmark	Denmark	US	Netherlands	Australia
3	New Zealand	Australia	UK	Sweden	Norway	Canada	UK	Singapore
4	Singapore	Denmark	Sweden	UK	US	UK	Denmark	France
5	Norway	UK	S Korea	S Korea	Netherlands	Netherlands	US	Netherlands
6	Canada	Canada	Australia	Australia	S Korea	Norway	France	Japan
7	UK	Norway	Canada	Singapore	Canada	Denmark	Sweden	US
8	Netherlands	Switzerland	Singapore	Canada	Australia	Australia	Norway	UK
9	Denmark	Germany	Finland	Finland	France	Spain	Finland	New Zealand
10	Germany	Finland	Norway	Norway	UK	France	Singapore	Finland
11	Sweden	Netherlands	Netherlands	Germany	Japan	Singapore	Canada	Canada
12	Belgium	Singapore	Germany	Netherlands	Switzerland	Sweden	Australia	Spain
13	Finland	S Korea	New Zealand	New Zealand	Estonia	Bahrain	New Zealand	Norway
14	France	New Zealand	Iceland	Japan	Luxembourg	New Zealand	Liechtenstein	Sweden
15	S Korea	Iceland	Switzerland	Iceland	Finland	Germany	Switzerland	Estonia
16	Spain	Estonia	Belgium	Austria	Austria	Belgium	Israel	Denmark

Source: United Nations E-Government Survey³

Although the Scandinavian countries are no longer in the top ten on the United Nations E-Government survey, the picture is not entirely bleak. The Scandinavian countries perform well in similar rankings such as: OECD Government at a Glance 2013⁴, The global Information Technology Report 2013 by the World Economic Forum⁵ and The state of Broadband 2013: Universalizing Broadband, by the Broadband Commission⁶. However we found during this study that there is substantial room for improvement at the municipal level in all three countries.

³ <http://egovau.blogspot.no/2014/06/australia-leaps-to-2nd-place-in-united.html>

⁴ http://www.oecd.org/gov/Government_at_a_Glance_launch_presentation.pdf

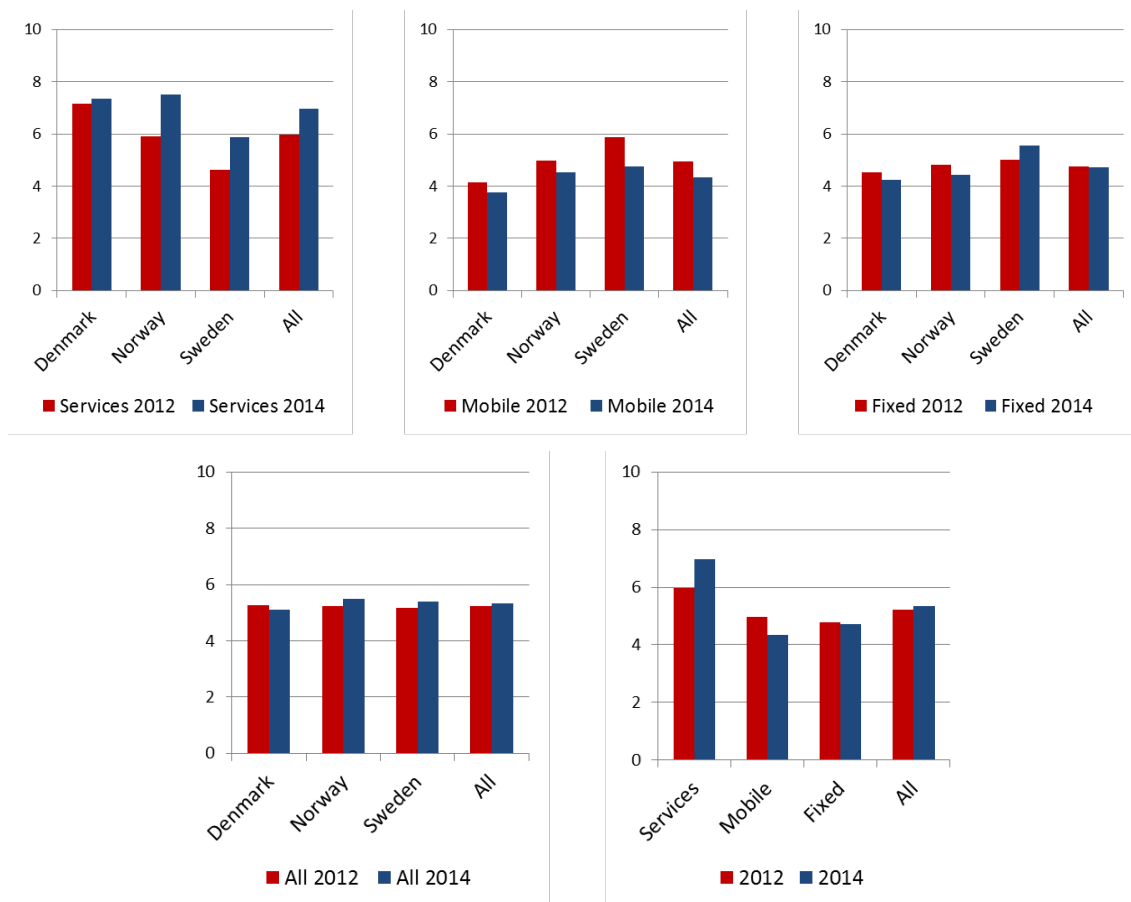
⁵ <http://www.weforum.org/reports/global-information-technology-report-2013>

⁶ <http://www.broadbandcommission.org/Documents/bb-annualreport2013.pdf>

3.2 Main findings

The “gold standard” we created for the different services in the NBCI in 2012 entails a score of 10 for each category (services, mobile, fixed and total). As can be seen from the figure below, the municipalities have, on average, a substantial improvement potential.

Figure 6 - Main findings 43 cities: services, mobile, fixed and all 2012 and 2014 (Max score: 10)



Source: Nexia DA

Several municipalities did quite well, with Linköping (SE), Västerås (SE), and Kristiansand (NO) receiving the highest overall total score. The winner of the NBCI two years ago, Asker (NO), is down to 9th due to lower fixed scores (down from 7.0 to 4.0). Stockholm fell from 2nd to 12th place mainly due to a lower mobile score, while Kristiansand (NO) managed to keep its 3rd position from 2012.

Figure 7 - Top 10 municipalities in 2014

Score from NBCI 2014							
Included in 2012?	Country	Municipality	Services	Mobile	Fixed	Final score	Rank
✓	Sweden	Linköping	8,0	5,3	7,1	6,8	1
✓	Sweden	Västerås	8,4	5,2	6,3	6,6	2
✓	Norway	Kristiansand	8,8	5,2	5,6	6,5	3
✓	Norway	Bodø	6,2	7,5	5,4	6,4	4
✓	Norway	Tromsø	6,7	6,6	5,7	6,3	5
✓	Sweden	Borås	6,1	7,5	5,0	6,2	6
✗	Norway	Skien	6,5	6,2	5,8	6,2	7
✓	Sweden	Göteborg	6,6	5,1	6,8	6,2	8
✓	Norway	Asker	8,9	5,2	4,0	6,0	9
✓	Sweden	Uppsala	5,4	4,7	7,4	5,8	10

Source: Nexia

There are no Danish municipalities in the top ten this year. The best Danish municipality, Copenhagen only came 16th overall. Denmark obtained a high average score (7.3) for services, but the lowest score for both mobile (3.8) and fixed (4.2) network deployment. Denmark was the overall winner of the Index in 2012 and this year they are surpassed by both Norway and Sweden as far as total average country score is concerned. Norway and Sweden show the largest total increase from 2012 to 2014 and this is mainly due to services for Norway and services and fixed network deployment for Sweden.

Figure 8 - Average country score 2014 compared to 2012

Average Country Score 2014												
Country	Services 2012	Services 2014	Diff. Services	Mobile 2012	Mobile 2014	Diff. Mobile	Fixed 2012	Fixed 2014	Diff. Fixed	All 2012	All 2014	Diff. All
Denmark	7,2	7,3	0,2	4,1	3,8	-0,4	4,5	4,2	-0,3	5,3	5,1	-0,2
Norway	5,9	7,5	1,6	5,0	4,5	-0,4	4,8	4,4	-0,4	5,2	5,5	0,3
Sweden	4,6	5,9	1,3	5,9	4,8	-1,1	5,0	5,6	0,6	5,2	5,4	0,2
All	6,0	7,0	1,0	5,0	4,3	-0,6	4,8	4,7	-0,1	5,2	5,3	0,1

Source: Nexia

Of the three focus areas, public online services received the highest scores in this year's study, as was the case in 2012. The average score across all countries was 7.0 out of 10, up from 6.0 two years ago. Norway increased average score from 5.9 to 7.5, Denmark from 7.2 to 7.3 and Sweden from 4.6 to 5.9. Swedish municipalities still lag behind Norway and Denmark and need to keep pushing for more and better digital services and increase work on welfare technology if they are to catch up with their Scandinavian counterparts in the area of digital services.

Mobile scores, on the other hand, are very different. The average mobile network facilitation score across all municipalities was 4.3, which is down from 5.0 in 2012. It is concerning that all countries show a lower mobile score compared to the 2012 NBCI. It is increasingly difficult to get access to public building and grounds in Norway and Sweden and while Denmark still struggles with high site costs, the decrease since 2012 for the Danish municipalities is mainly due to a lower overall impression, collaboration and effectiveness. It should be noted that there are positive developments afoot in Denmark that may increase Denmark's mobile score in the next NBCI.

For fixed network facilitation, the average score is down from 4.8 to 4.7. The difference consists of lower scores in Norway (from 4.8 to 4.4) and Denmark (from 4.5 to 4.2) and an increase in Sweden (from 5.0 to 5.6). The Swedish increase is mainly attributable to a more

positive attitude towards microtrenching. Many Swedish municipalities have invested in broadband networks for years and display a better understanding of the importance of fixed network and broadband facilitation than the Norwegian and Danish municipalities.

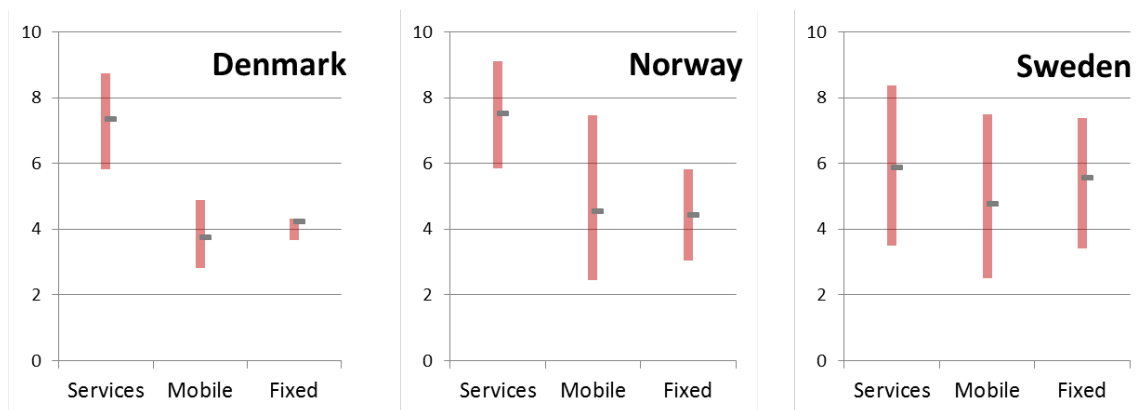
Several municipalities have managed to improve many of the services we measured in 2012, but there are few municipalities, which recognize their own importance in network deployment. The increasing importance of a robust network infrastructure will make municipalities more dependent on network operators. Municipalities may have problems delivering more complex digital services (i.e. welfare services) to their inhabitants if the network infrastructure is not robust and have great area coverage. This marks a significant shift from the status quo, where the network operators are dependent on the municipalities in order to put up mobile base stations and fiber on municipal property. The shift is already apparent in Denmark where the push for better infrastructure is in many cases coming from the public.

3.3 Variations between (and within) municipalities

Denmark is more homogenous

As outlined in the figure below, the Danish scores show less variation than Sweden and Norway. This is mainly due to national rules and regulations.

Figure 9 - Great variations



Source: Nexia DA

The results in this year study are similar to the study two years ago. The Swedish municipalities show the greatest variation as far as services are concerned. Sweden has both one of the highest-scoring cities in digital services (Västerås, at 8.4) and the lowest-scoring city in that category. The same is true for Norway in the mobile network facilitation category: the city of Bodø scores 7.5 while two other Norwegian cities are at the bottom of that list.

The Swedish municipalities also show the greatest variation for fixed network deployment. Here, the Danish municipalities show very little variation and they all score very low for fixed network deployment. In general, Danish cities follow national rules and policies for the facilitation of fixed networks.

Local rules and variations

We also found in this year's study that several municipalities had clear sets of rules and regulations, but applied them inconsistently. For example, a municipality will charge a higher price for the establishment of a base station if the individual city employee thinks the green area, where the base station is to be deployed, has beautiful surroundings. There have also been incidents of widely inconsistent interpretation of local rules.

This made it difficult for us to assign scores to some of the municipalities, but the lack of predictability in applying rules makes it even more difficult for the network operators who must deal with these municipalities. It also means that relationships to and personal chemistry with specific employees in the municipalities are important, as they may determine whether an operator will get the necessary permits or not. Such situations are more likely to be avoided by clear, transparent and quantified rules and regulations.

4 Digital services: A marked improvement

4.1 Main findings – digital services

Of the 43 municipalities in Scandinavia in the NBCI, Trondheim, Bærum and Asker (all Norwegian municipalities) came out on top for digital services. These municipalities all displayed high scores in almost all of the different categories of digital services and showed a solid understanding of the importance of digitalizing services. Norway did slightly better than Denmark and came out at the top of the list this year. Both Norway and Sweden show an impressive increase in digital services compared to 2012 (see Figure 11 - Average country score with and without welfare technology).

Four of the five municipalities with top scores for digital services are Norwegian. The lowest score for a Norwegian municipality is Skedsmo, with a score of 5.8. The Danish municipalities did also quite well, as they did two years ago. Copenhagen has the highest score of the Danish municipalities with 8.8 and the lowest municipality in Denmark had a score of 5.8.

The lower score for Swedish municipalities is linked to a lower score on ICT strategy, online building permit, Fix-My-Street and Welfare Technology. However, Västerås, Stockholm and Linköping all had a score of 8 or higher, while Jönköping, Umeå and Malmö had a score less than 4.5.

Figure 10 - Overview – rating of digital services for all municipalities

	Denmark		Norway		Sweden
København	8,8	Bærum	9,1	Västerås	8,4
Århus	8,5	Trondheim	9,1	Stockholm	8,0
Frederiksberg	8,4	Asker	8,9	Linköping	8,0
Herning	8,2	Kristiansand	8,8	Göteborg	6,6
Esbjerg	8,2	Stavanger	8,5	Norrköping	6,2
Randers	7,9	Bergen	8,2	Borås	6,1
Odense	7,8	Sandnes	8,0	Örebro	5,9
Horsens	7,6	Sarpsborg	7,2	Uppsala	5,4
Silkeborg	7,1	Drammen	6,8	Helsingborg	5,0
Viborg	7,1	Tromsø	6,7	Eskilstuna	4,8
Vejle	6,9	Fredrikstad	6,6	Malmö	4,4
Aalborg	6,3	Oslo	6,6	Umeå	4,1
Roskilde	6,0	Skien	6,5	Jönköping	3,5
Helsingør	5,9	Bodø	6,2		
Kolding	5,8	Skedsmo	5,8		

Source: Nexia DA

Norway has seven municipalities with a score of 8.0 or higher while Denmark has five and Sweden three. Both Copenhagen (DK) and Stockholm (S) are big cities with complex organizations that show an admirable, strategic drive to make digital services available to everyone. Copenhagen has a number of digitalized local services with high usage. The same is generally the situation in Stockholm. Among the really big cities in the Nordic, these two stand out as targeted and foresighted in modernizing public services. Oslo, on the other hand, has

one of the lowest scores among the Norwegian municipalities for services. It is therefore encouraging to see that Oslo has decided to spend NOK 550 million in the budget for the next 3 years on digital development⁷.

The increase in Norway and Sweden may be related to the extensive work that both Norwegian and Swedish governments have done in order to develop national standards in the recent years. All the Scandinavian countries show an increase from two years ago, even though the inclusion of welfare technology reduces the score for all three countries as shown in Figure 11. This is especially true for Sweden where the average Digital Services score would increase from 5.9 to 6.8 if welfare technologies were excluded. Swedish municipalities seem to put fewer efforts into welfare technology than cities in Denmark and Norway.

Figure 11 - Average country score with and without welfare technology

Average Country Score 2014 Services (WF)			
Country	Services 2012	Services 2014	Services 2014 (-WF)
Denmark	7,2	7,3	7,7
Norway	5,9	7,5	8,0
Sweden	4,6	5,9	6,8
All	6,0	7,0	7,5

Source: Nexia

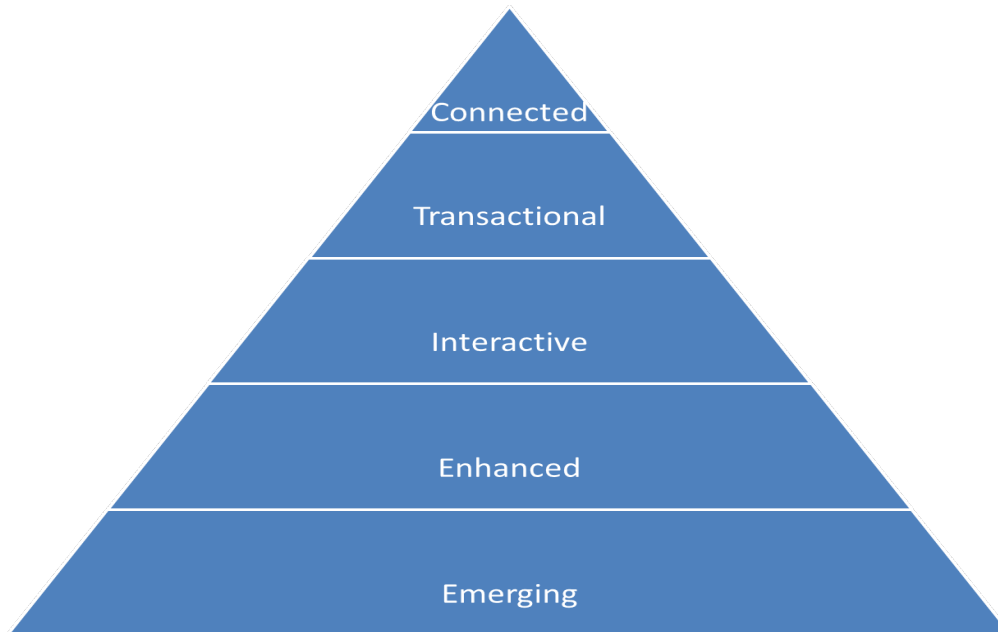
Municipalities in Denmark and Norway seem more prepared for welfare technology and many are actively preparing to deploy such services in order to reduce cost and to prepare for the expected large increase in the older population.

4.2 Background for choosing services in the Index

We decided to include online services in the NBCI and to assign them one third of the total weight, for several reasons. First of all, online services can drive both internal and external improvements and services can provide an indication of how sophisticated a municipality is in terms of how high it scores on the UN model of Phases of Web Measure Index from the UN E-Government study 2008, outlined in the figure below.

⁷ <http://www.digi.no/930609/it-sinke-skal-bli-fyrtaarn>

Figure 12 - Phases of Web measure Index



Source: United Nations E-Government Survey 2012⁸

The services of the municipalities were assessed via a thorough search on each municipality's website and other relevant websites. In addition to being assessed for content and features, the municipal sites were tested for web content accessibility and user-friendliness.

We found that the municipalities did better than in 2012. Many municipalities are "fully connected" and integrated in several channels. They are offering secure digital services to their inhabitants which enables the municipalities to utilize new ways of interacting with their inhabitants and gives them the ability to offer new and sophisticated services such as digital welfare technology. Many Danish municipalities already offer digital welfare technology, so much so that according to one source "in Denmark it is not called welfare technology, but everyday technology".

The biggest change we saw versus 2012 in the area of services is that municipalities today are being pushed by their respective national municipal organizations to a larger extent. We see this in Norway and Denmark and to a certain extent also in Sweden. These organizations set the goals and decide on the digital architecture and common technological platforms. This push for change makes it easier and less expensive for municipalities to deploy services.

4.3 Variables and weights

The services part of the index is a composite of the eight different indicators this year, up from six in 2012. Each indicator is given a weight depending on importance as outlined in the figure below.

⁸ <http://unpan3.un.org/egovkb/Portals/egovkb/Documents/un/2012-Survey/unpan048065.pdf>

Figure 13 - Digital municipal services

Area	Low score	High score	%
The presence of an ICT strategy*	Not or only partly present	Comprehensive (services + infrastructure), updated, followed up	25
Availability of digital services:			30
Online daycare application and selection process	Not available	Available, high functionality and easy to use	
Online residential building permit application and approval process	Not available	Available, high functionality and easy to use	
Online feedback/reporting for "Fix my Street" functionalities	Not available	Available, high functionality and easy to use	
Electronic invoicing	Not available	Available, promoted, bank integration	
Electronic communication with municipality			
Secure communication with public authorities	Not or partly available	Available, promoted, standards-based, easy to use	20
Availability of electronic communications channels	Available, but limited promotion / usage	Widely available and actively promoted	
Welfare technologies			25
The municipal readiness for welfare technologies	Not present in municipal plans or budgets	Welfare technologies in use or active participation in pilot projects	
The municipal use of welfare technologies	Not available	Available, high functionality and easy to use	

Source: Nexia DA

4.3.1 ICT strategy

ICT Strategy was chosen as an important part of the service index, because it is possible to understand a lot of issues the municipalities are dealing with by reading their ICT Strategies. When reviewing and scoring the ICT strategies, we looked for the following factors:

- Is it publicly available and easy to find?
- Is it current and easy to understand?
- Does it contain anything about the importance of broadband for the municipality and the region, specific goals, a plan to achieve the goals, and an evaluation of whether the goals had been achieved?
- Does it contain an outline of the ICT organization, roles and decision-making power?
- Does it outline services/e-services, with clear goals on how and when to include them in the e-program?
- Does it address standardization, integration and ICT architecture?
- Does it address network accessibility?
- Does it address financing and ownership of necessary hardware and software?
- Does it address communications infrastructure issues such as fixed and mobile networks to inhabitants, schools and other municipal offices?
- Does it address ICT support? Information security? Green IT?
- Does it cover cooperation with other municipalities, companies, institutions, developing companies, piloting of new services and the use of consultants (if relevant)?

- Does it say anything about a broadband coordinator, cooperation with others that dig ducts and public possibilities for financing the building of networks?

In Sweden all the operators and stakeholders in the ICT infrastructure industry formed a forum called “Bredbandsforum”. This forum has come up with a “golden standard” for the Swedish municipalities and their ICT strategies⁹ in order to help all the municipalities. In Denmark Kombit has made a “golden standard”¹⁰ and in Norway, KommiT¹¹ has done the same. This makes it easier for the municipalities to know what to include in an ICT strategy.

The municipalities with the most comprehensive ICT strategies two years ago are still performing well in this area. They include Asker, Bærum, and Bergen in Norway, Stockholm and Linköping in Sweden, and Fredriksberg, København and Århus in Denmark. In addition, we have found that Västerås, Kristiansand and Trondheim can be added to the list of municipalities with high quality ICT strategies.

We did find, as in NBCI 2012, great variations among municipalities. However, there were fewer municipalities this year that did not have their ICT strategies available online at all.

4.3.2 Online daycare application

Online Daycare application is a widely available service. With the exception of three Swedish municipalities (versus four in 2012), all municipalities we looked at had an online daycare application service. However, it is important to stress that we were only able to look at the front end of the service since most of the municipalities require a log-in for this service. It was therefore difficult to see which of the municipalities had a fully electronic service, and which ones only had an electronic front (followed up by using paper and traditional mail).

4.3.3 Online building permits

This category clearly showed that the Danish and Norwegian municipalities have focused on online building permit application services since the last NBCI two years ago. In our last survey, 12 out of 15 Danish cities and 13 out of 15 Norwegian cities had the service. This time all of the municipalities in Denmark and Norway offer the online building permit service to their inhabitants. In Norway all the municipalities in this survey use “ByggSøk”, which is a service developed by the central Norwegian authority for building regulations. The Swedish municipalities, however, have not had the same focus, as only 5 out of 13 municipalities obtained the top score in this section. This is up from 2 of the 13 Swedish municipalities two years ago.

4.3.4 “Fix-My-Street”

“Fix-My-Street” is a service requiring a bit more from the municipalities, since we are looking for feedback/reporting, sharing of information and more flexible input in our search. We found a lot of different “Fix-My-Street” systems, where some municipalities have a full-fledged solution, while others still only offer telephone and/or e-mail. We also found that some of the “Fix-My-Street” services only offer e-mail as communication and not a fully-fledged online integrated system.

⁹<http://bredbandivarldsklass.se/Global/Dokument/Slutrapport%20-%20Arbetsgrupp%204%20-%20undanröjande%20av%20identifierade%20hinder.pdf>

¹⁰<http://www.kombit.dk/indhold/kombits-strategi>

¹¹<http://www.ks.no/PageFiles/15910/KS%20Digitaliseringsstrategi.pdf>

Many digital systems we looked at allowed inhabitants to give feedback on almost everything, from pot holes and street lamps to garbage, rats and food poisoning. To achieve a full score, a municipality had to have a well-integrated “Fix-My-Street” solution that was easy to find. It also needed to be intuitive and give the user several different ways of inputting data. In addition, it needed to give the user an easy overview of other user’s remarks and complaints, as well as online feedback from the municipality when the issue was taken care of or fixed. Excellent examples were seen in Denmark, where 6 of the 15 municipalities obtained the top score. In Norway 10 of 15 municipalities obtained top score, versus only 2 out of 13 in Sweden. Two municipalities in Sweden, two in Denmark and one in Norway received the lowest score.

4.3.5 Digital invoicing

Digital invoicing is also a service in the transactional part of the service pyramid outlined in Figure 12 - Phases of Web measure Index. With this service, the focus was on whether the municipality offers digital invoicing (“e-faktura”) to its inhabitants. In other words, could the inhabitants pay for municipal services by using digital invoicing? If so, was this offered for all municipal services, was the service integrated well in the overall web solution, was it easy to find on the municipality website, and did the municipality offer it as a clear first choice?

Digital invoicing is a national standard in Denmark and all the Danish municipalities surveyed received the perfect score, as they did in 2012. The change this year was that all the Swedish and Norwegian municipalities also received a full score for digital invoicing.

4.3.6 Secure communication

Already in 2007, Denmark required organizations to implement a common IT security standard. Today anyone over the age of 15 holding a Danish CPR number and who is a registered resident of Denmark can obtain a digital signature. This ensures that the Danish municipalities all receive the highest score since they already have secure communication between the municipalities and all its inhabitants, ensuring the ability to share sensitive information in digital channels.

There have been large changes in Norway and Sweden since the last NBCI also for secure communications; all municipalities that we studied now offer secure communication to their inhabitants. Norway has introduced a common secure and free infrastructure towards the public sector (ID Porten). Inhabitants can choose different ID solutions in order to log on to ID Porten. Min ID is public and Bank ID, Buypass and Commfides are the commercial options users can log on with. 240 Norwegian municipalities are currently using the secure communication solution and adoption is continuing to increase¹².

In Sweden the government has developed the public site e-legitimation.se where people can find links to the different eID issued websites of Bank ID, Nordea and Telia.

Interestingly, the three countries have chosen different solutions. Denmark has a fully public solution, in Norway one can choose between public and private solutions, while in Sweden the solutions are fully private.

4.3.7 Welfare technology (e-health)

Welfare technology has been added to the Nordic Broadband City Index for 2014. Welfare technology is a good differentiator between the municipalities which are proactive and have

¹²<http://www.regjeringen.no/nb/dep/kmd/pressesenter/pressemeldinger/2014/Fleire-digitale-tenester-til-innbyggjarane.html?id=767415>

good plans/strategies and offer welfare services to their inhabitants and those who do not. By welfare technology or e-health we mean health services and information delivered or enhanced through the internet and related technologies.

The Norwegian Ministry of Health and Care Services states: “The use of welfare technology opens up many opportunities. Such technology can help people to cope with their daily lives and health issues, allow more people to live longer in their own homes despite reduced functionality, and help to prevent or postpone admission to an institution.”¹³

Welfare technologies or e-health may be an important “killer application”¹⁴ for the municipalities since it can both increase service quality and reduce overall costs. Hence, it is important for development of e-government services on the whole. The importance of welfare technology has been recognized in Norway, where the government has established InnoMed¹⁵, while the government of Denmark has set aside a fund of DKK 3 billion in order to stimulate welfare technologies. The Swedish government has a national initiative called Nationell e-hälsa¹⁶ and they have established Vinnova¹⁷, a company which distributes SEK 2.7 billion a year to companies in order to strengthen Sweden’s innovativeness, aiding sustainable growth and benefiting society.

In evaluating municipalities, our focus was twofold:

1. The municipal readiness for welfare technologies (“welfare ready”)
 - a. Do they have a strategy/plan, and does it have the right content?
 - b. Do they have a budget?
 - c. Do they co-operate with others (municipalities, private companies, public actors, EU, etc.)?
2. The actual use of welfare technologies (complexity of the technology and number of services/technologies used) (“welfare use”)
 - a. Do they have any digital welfare solutions up and running and how complex are they?
 - b. Do they have any digital welfare solutions in test?
 - c. Are they planning any tests?

Figure 14 Average country score on welfare technology

Average Country Score 2014 WF		
Country	WF Ready	WF Use
Denmark	5,5	6,7
Norway	6,9	6,4
Sweden	2,5	2,5
All	5,1	5,3

Source: Nexia

¹³ <http://www.regjeringen.no/en/dep/hod/documents/regpubl/stmeld/2012-2013/meld-st-29-20122013-3/2/5/3.html?id=735335>

¹⁴ http://en.wikipedia.org/wiki/Killer_application

¹⁵ <http://www.innomed.no/nb/om-innomed/>

¹⁶ <http://www.nationellehalsa.se>

¹⁷ <http://www.vinnova.se/en/>

The Danish municipalities score well on welfare technology overall and for “welfare use” they have the highest score. Several cities have implemented a lot of different welfare technologies already and they have greatly benefited from the work of Kombit, a municipal IT community that has created a common architecture and platform for all the municipalities. Great examples from Denmark were found in Copenhagen, Aalborg, Esbjerg, Fredriksberg and Horsens.

Norway, on the other hand, obtains the highest score on “welfare ready”, with 6.9. In Norway, KommIT was created (copy of Kombit in Denmark) in order to create a common ICT architecture and principles for all the municipalities. They have not finished this work yet, but are working in order to help the Norwegian municipalities. We suspect that the Norwegian municipalities are awaiting the work of KommIT before they invest substantial resources into “welfare use”. In Norway, “Welfare use” consists mainly of pilot projects in many different areas, but few municipalities have fully-integrated digital welfare solutions to offer their inhabitants. Given that KommIT is working on a common platform for all municipalities, we have not deducted a lot of points from the Norwegian municipalities in this area, as Kommit is expected to launch its solution soon. The best Norwegian examples we found were Trondheim, Stavanger, Skien and Bodø.

The Swedish municipalities received a relatively low score in both “welfare ready” and “welfare use”. SKL has had an initiative on e-health since 2006¹⁸, but a lot of the municipalities did not have any information on their web pages regarding welfare technology and have therefore received the lowest score. We did however find excellent municipal examples in Göteborg, Västerås, Linköping and Uppsala.

¹⁸ <http://www.skl.se/halsasjukvard/ehalsa.1067.html>

5 Mobile network deployment: A matter of concern

Even though mobile and fixed network deployments are becoming more and more similar, we decided to divide them up into two groups given that they still have unique issues.

5.1 Main findings: mobile network deployment

In this component, the Danish municipalities had the lowest average score (see Figure 15 - Overview – rating of mobile network facilitation for all municipalities). The clear winners in mobile network facilitation were Bodø (NO) and Borås (SE). They both offer effective and flexible application management, excellent access and lease costs, and a plan to facilitate deployment through spatial regulation. This makes the rollout of modern, mobile services smooth and effective.

Figure 15 - Overview – rating of mobile network facilitation for all municipalities

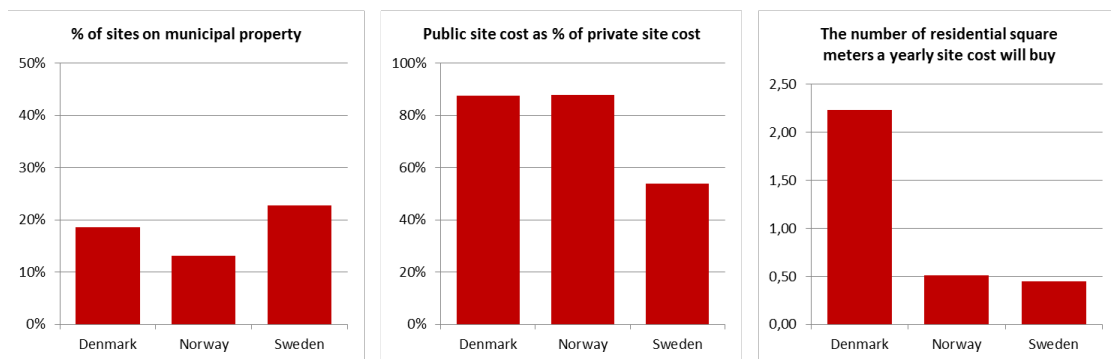
	Denmark		Norway		Sweden
Horsens	4,9	Bodø	7,5	Borås	7,5
Roskilde	4,8	Tromsø	6,6	Norrköping	6,5
Helsingør	4,4	Skien	6,2	Umeå	6,1
Odense	4,2	Asker	5,2	Linköping	5,3
Esbjerg	4,0	Kristiansand	5,2	Västerås	5,2
Randers	3,8	Drammen	4,9	Helsingborg	5,1
Herning	3,8	Fredrikstad	4,7	Göteborg	5,1
Viborg	3,7	Oslo	4,7	Uppsala	4,7
Vejle	3,7	Bergen	4,3	Örebro	4,4
Frederiksberg	3,6	Trondheim	4,1	Stockholm	3,3
København	3,5	Bærum	3,8	Malmö	3,1
Kolding	3,4	Stavanger	3,1	Jönköping	2,8
Aalborg	3,0	Sarpsborg	2,8	Eskilstuna	2,5
Silkeborg	2,9	Skedsmo	2,5		
Århus	2,8	Sandnes	2,5		

Source: Nexia DA

As opposed to online services, the results above show that Denmark has by far the lowest average score and this is mainly due to the struggle with high lease costs. Norwegian and Swedish cities have lower site cost, but difficulties getting access to public buildings and grounds. The low average score of 4 for all countries for mobile deployment does not make it easy for network operators and may have negative impact on the mobile coverage in the municipality.

The high prices on mobile site costs in Denmark compared to Sweden and Norway can be seen in Figure 16 - Main findings – mobile site costs.

Figure 16 - Main findings – mobile site costs



Source: Nexia DA

As the first graph indicates, there are many more sites on public property in Sweden (23 %) than in Denmark (19 %) or Norway (13 %). It is interesting to note that the number of sites on municipal property is almost twice as high in Sweden as in Norway.

The second graph analyzes the public site cost as a percentage of private costs. Here Denmark and Norway are the highest with 88 % and Sweden 54 %. This may also explain some of the reason why there are a lot more sites on public property in Sweden than in Denmark and Norway.

The last graph outlines the number of residential square meters a yearly site cost will buy. Denmark is a lot higher than both Norway and Sweden. This corresponds well with what the experts have told us about Denmark, where the high lease costs are likely to impede future capacity and coverage growth.

However, there are changes underway in Denmark which may impact Denmark's score in the next NBCI. After the last NBCI, operators in Denmark faced increasing price demands from municipalities for mobile site deployment. Network operators refused to pay the higher prices, and the municipalities countered by removing the mobile sites in question. Inhabitants of the municipalities in question voiced their dissatisfaction over the resulting poorer network coverage to the media. This forced the municipalities into dialogue with the network operators, and resulted in the municipalities better understanding their own important role in network deployment. They also realized that without network infrastructure they would not be able to offer their inhabitants the digital services that they expect.

The result of the dialogue was not just better cooperation and new principles for mobile network deployment (a new pricing structure for mobile base stations) in these municipalities. It also led to approximately 20 other municipalities in Denmark adopting the new principles. The Danish Konkurrence- og Forbrugerstyrelsen (The Competition and Consumer Authority) did not have any objections and Erhvervsstyrelsen (The Danish Business Authority) has included the principles in their recommendations¹⁹.

We believe that the development in Denmark will eventually also reach municipalities in Norway and Sweden. When municipalities understand the importance of network infrastructure and their own important role in network deployment, then they will cooperate and ensure the best principles for network deployment.

¹⁹ <http://hoeringsportalen.dk/Hearing/Details/37885>

5.2 Variables and weights

The variables, weights, and the “gold standard” for each element are outlined in the figure below. The four different elements together comprise the mobile component of the NBCI, which accounts for a third of the total NBCI score.

Figure 17 - Mobile network deployment

Area	Low score	High score	Weight
Access to public ground and buildings	No access	Active support, relatively many installations	40
Site lease costs	Relatively high lease costs	Relatively low lease costs	30
Effectiveness & operator service	Normally long wait to get applications approved	Short waits, can-do attitude, proactive	20
Mobile masterplan	No such thing	Predictable, transparent	10

Source: Nexia DA

5.2.1 Access

When building a mobile network, getting access to public buildings and grounds is very important. Due to the importance of access, we have assigned access 40 % of the total score for mobile deployment.

The score for access is based on two equal inputs, with 50 % consisting of what we have been told by the local contractors, consultancies and other experts, and 50 % consisting of the share of Telenor (and TeliaSonera in Denmark) sites on public grounds in the municipality.

We think the percentage of sites the operator has on public properties is a good indicator of whether or not the municipalities have successfully facilitated mobile network deployment. The analysis, however, should be taken with a grain of salt. Some municipalities have few sites on their properties because the network operators rarely asked to put up any sites. Therefore, we gave equal importance to qualitative information from the expert interviews.

Swedish municipalities have almost twice the share of mobile sites on their property compared to Denmark and Norway. We think the most important reason is positive city policies, but it should also be noted that many Swedish cities have an extensive property portfolio.

Municipalities that achieved the highest scores and the lowest scores were all Norwegian, with Bodø, Tromsø and Skien at the top of the list and Stavanger and Sandnes on the bottom of the list.

5.2.2 Lease cost

Lease cost is a difficult area to analyze for several reasons:

- Prices are higher in the larger cities than in smaller cities. It would not be fair to compare actual prices since the smaller municipalities would do a lot better than the large.
- The general real estate price level differs between and within the countries.

In order to conduct a fair analysis we looked at site costs from two different angles: the public site cost as a percentage of private site cost and the number of residential square meters (in the city) a yearly site cost will buy. We received access to Telenor's (and TeliaSonera's in Denmark) site information for more than 5 200 public and private sites in the NBCI cities.

Public site cost as a percentage of private site cost

Since it was deemed unfair to directly compare site costs in one municipality with costs in another municipality, we decided to compare the public site cost to the private site cost within each municipality. This way we could see if the public site cost was a lot higher or a lot lower than the site cost on private properties. The findings were interesting since we found that many of the public sites were significantly more expensive than the private sites in several municipalities. Average private site costs are less expensive in cities such as Jönköping, Norrköping and Helsingborg.

The number of residential square meters a yearly site cost will buy

We needed a way to compare site costs between municipalities. In order to do this we looked at the house price information for the respective municipalities²⁰. We broke this down into a price per square meter for small villas, which we then used to calculate how many square meters of property we would get for the cost of a public site in the municipality. This enabled us to compare actual site costs between the municipalities independent of country and size. Our main finding in this area was that Denmark has very high site costs. Norwegian and Swedish lease costs are more affordable when compared to the general level of real estate prices.

5.2.3 Overall impression, collaboration and effectiveness

In this part we asked the network building entrepreneurs, consultancies and other experts to give us feedback on how easy or difficult it is to work with the municipalities. Issues that were given weight were how easy it is to collaborate with the municipality, how effective they are, and an overall impression after having worked with the municipality. In order to come up with a grade for all the municipalities, several sources were interviewed per municipality. When the grade given by the different experts differed, an average grade was used.

It was noted that it might be more difficult for the larger municipalities to get a high score since they often have several departments one had to communicate with in order to get things done and permits accepted. However, this supposition was not supported by our findings, with Oslo scoring fairly well, Copenhagen placing in the middle and Stockholm in the bottom half.

The municipalities that obtained the highest score on collaboration and effectiveness were Tromsø (NO), Kristiansand (NO), Norrköping (SE), Odense (DK), Drammen (NO) and Oslo. The municipalities with the lowest scores were Uppsala (SE), Århus (DK), Sarpsborg (NO), Örebro (SE) and Stockholm (SE). Interestingly, Stockholm obtained one of the highest scores two years ago and Oslo one of the lowest.

Several of the network contractors, consultancies and other experts we talked to pointed out the importance of individual relationships. If the personal chemistry was good, then it was easier to work with the municipality and problems were usually solved effortlessly, while the opposite was true if the personal chemistry was not good.

²⁰ Sources: Eiendomsmeglerforetakenes forening / Econ (Norway), Svensk Mäklarstatistik AB (Sweden), Boliga.dk (Denmark)

5.2.4 Mobile master plan

For a mobile network builder, having clear rules and regulations can be paramount since it can make it a lot easier to plan, build and deploy a network. We therefore included a mobile master plan in our survey where we wanted to know if the municipalities had a clear plan for mobile deployment in their area. In addition, we also wanted to know if this plan was published and easily available for individuals interested in the plan. This year we also added whether the plan was current and network facilitation friendly.

Most cities do not have a mobile master plan, and it appears that some do not think that mobile network deployment is very important. Many Danish municipalities and some Swedish municipalities did get some points for having guidelines for mobile network builders. A lot of these however, are old and not very good. In Norway, Bodø was the only city where our interviewees felt that the municipality has a plan in the area of mobile network deployment.

6 Fixed network facilitation: generally difficult

Municipalities' ability to secure a smooth and reasonably flexible facilitation of fixed broadband development received an average score for all municipalities of 4.7, just below the 4.8 for 2012 and well below the 5.3 average across all categories. Not surprisingly, digging and road modification cause local frustration and tension that cities need to manage and reduce, together with contractors and operators.

6.1 Main findings for fixed network facilitation

The Danish municipalities display few variations and a low score. Norway display more variation, while Sweden has the most variation with scores from 8.2 to 3.4.

Figure 18 - Overview – rating of fixed network facilitation for all municipalities

	Denmark		Norway		Sweden
Aalborg	4,3	Skien	5,8	Uppsala	7,4
Esbjerg	4,3	Tromsø	5,7	Linköping	7,1
Frederiksberg	4,3	Kristiansand	5,6	Göteborg	6,8
Helsingør	4,3	Bodø	5,4	Eskilstuna	6,4
Herning	4,3	Bergen	5,0	Västerås	6,3
Kolding	4,3	Drammen	5,0	Malmö	6,2
København	4,3	Oslo	4,7	Stockholm	5,9
Odense	4,3	Skedsmo	4,4	Borås	5,0
Randers	4,3	Asker	4,0	Umeå	4,9
Roskilde	4,3	Bærum	3,8	Norrköping	4,7
Silkeborg	4,3	Trondheim	3,8	Örebro	4,3
Viborg	4,3	Sarpsborg	3,6	Helsingborg	3,7
Århus	4,3	Sandnes	3,5	Jönköping	3,4
Horsens	3,7	Stavanger	3,3		
Vejle	3,7	Fredrikstad	3,1		

Source: Nexia DA

Uppsala (SE), Linköping (SE), Göteborg (SE) and Eskilstuna received the highest fixed network scores. These municipalities display a good understanding of the importance of fixed network and broadband facilitation and they allow microtrenching. The investments Swedish municipalities have made in fiber networks might influence their more positive attitude towards fixed network facilitation. It is disappointing to see that Asker – the 2012 NBCI winner – gets a fixed rating of 4.0, down from 7.0 two years ago. Norway has six municipalities with a score lower than 4. These municipalities receive the lowest score in the categories of trench depth, fees, duct deployment, duct rental and fiber rental.

The investment in fiber networks amongst the Swedish municipalities might also explain why Sweden has six municipalities with a score higher than 6 for fixed network deployment, while Norway and Denmark does not have any. The Swedish municipalities seem to offer better fixed network facilitation than both the Norwegian and Danish municipalities. Due to a higher degree of national regulations, there is low variation among Danish cities compared with Norwegian and Swedish cities.

There is significant room for improvement for fixed network deployment for all of the surveyed municipalities. It seems that many cities do not see the importance of fixed network deployment and fail to see the connection between strict digging regulations and poor network quality. Denmark has many national rules and regulations, making life more predictable for network operators. Unfortunately, in our view, the rules are consistently bad.

We also found that most of the municipalities have deep digging requirements. According to many of the experts we talked to, this was mainly because “the rules had always been that way”. Given the high importance of this, both local governments and national policy makers should base requirements on sound analysis and not unjustified traditions.

6.2 Variables and weights

The variables, weights, and the “gold standard” for each element are outlined in the figure below. The four different elements together comprise the fixed network component of the NBCI, which accounts for a third of the total NBCI score.

Figure 19 - Fixed network deployment

Area	Low score	High score	Weight
Flexible use			30
• Microtrenching	Never allowed	Generally allowed	
• Pole usage	Take down requirement	New poles allowed	
Fair pricing / costs			20
• Trench depths along suburban, low traffic road (when not microtrenching)	>= 60 cm	<= 39 cm	
• Re-surfacing requirements (for one simple crossing)	Very strict	Sensible	
• Fees (8x6 meter example)	High	Low	
Operator neutral?			30
• Does the city treat telecom operators in a fair and neutral fashion? Does the city have competing services?	Consistently operator non-neutral	Consistently operator neutral	
Role in network deployment and operations			20
• Maintains system for digging information available for operators	No	Yes, and 100% usage	
• Deploys ducts on own (or owned company) behalf when deploying other municipal infrastructure (e.g. roads)	No	Yes - always	
• Rents ducts to operators (if yes to above)	No	Yes – on fair terms	
• Rents fiber to operators			

Source: Nexia DA

6.2.1 Flexible use

Flexible use has two main variables: Microtrenching and pole usage.

Microtrenching

Microtrenching technologies for laying fiber have been tested out in several municipalities. While digging and re-instating the road for a traditional trench is a time-consuming and expensive exercise, microtrenching can avoid costs as it does not open up a large trench, but merely cuts a narrow slit that is sliced or sawn in the surface of the road. It makes use of micro-ducts with narrow, vertical cross-sections and small diameter fiber cables. Microtrenching will significantly reduce the cost of fixed network deployment since it is possible to dispense with expensive backfill material and road re-surfacing. However, microtrenching cannot be used everywhere and should not be relied upon as a ubiquitous

solution. Microtrenching should be treated as just one of a number of techniques, with different methods used in different places according to which are most suitable and cost-effective²¹. We only found four municipalities allowing microtrenching (all Swedish). Some more are currently testing it, but the large majority of municipalities decline microtrenching in their area. We have heard that one reason for declining microtrenching may be because the municipalities want the operators to pay for re-pavement of the roads.

Pole Usage

Poles are important in Norway and parts of Sweden, while they are rarely used in Denmark. This part is therefore only applicable for Norway and Sweden. When building and deploying a network in Norway and Sweden, using poles is important due to the topology and problems associated with digging in stone. It is also a lot cheaper to use poles in network deployment instead of having to dig trenches for fiber.

6.2.2 Fair pricing/costs

The different issues we looked at under fair pricing/costs were the following: Trench depths required when deploying fiber, re-surfacing required after having dug a trench, and the fees the network operator is required to pay the municipality for being able to dig on public grounds.

Trench Depth

The depth required when digging a trench is important from a cost perspective. The cost will in most cases increase the deeper you dig. In our questionnaire we asked how deep you had to dig in order to put down fiber on a low traffic road. We found that Denmark again had a national standard of 60 cm. Norwegian municipalities were also fairly unified at 60 cm, however three Norwegian municipalities require more than 60 cm and one require 50 cm. In Sweden, eight municipalities require 40 – 59 cm and six municipalities require 60 cm. Several of the Swedish municipalities were more flexible in their trench depth requirements.

Re-surfacing

Re-surfacing was considered another important cost element and we saw differences between the countries. Denmark has a national requirement for all municipalities and had therefore no variations. Norway on the other hand showed the largest variations from 0.5 meters on each side of the duct to several meters on each side. Skedsmo had a requirement of 25 meters on each side of the duct (50 meters in total). It is difficult to understand why digging in Skedsmo requires significantly more re-surfacing than in other municipalities. Swedish municipalities differ in their requirements for re-surfacing from 0.5 to 2 meters on each side of the trench.

Fees

Another cost element when digging a trench is the municipal fees one has to pay in order to obtain a digging permit. For fees, we only have data for Denmark and Norway. Denmark had again very little variation in their fees, where only Vejle and Horsens require substantial fees. In Norway Bærum, Asker, Drammen and Skedsmo have the highest fees.

Interestingly, smaller municipalities tend to be grateful that the network operators ensure good broadband networks to the people living in the municipality. Furthermore, the municipalities are also happy about the re-surfacing of the roads in their area.

²¹ Microtrenching is not a commonly used technique in Denmark according to our experts.

6.2.3 Operator neutrality

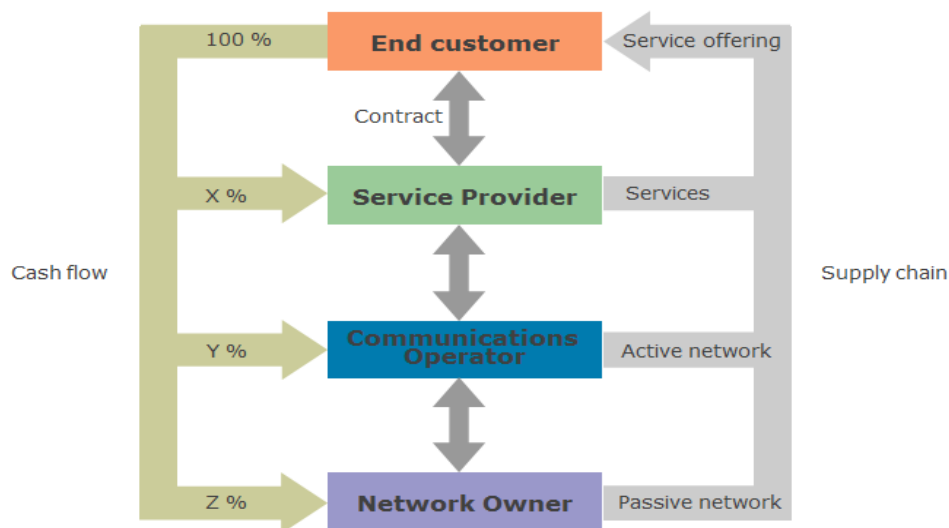
Given that municipal regulations and behavior has a major impact on operator cost levels, it is only natural that operator neutrality is an important part of the network facilitation scorecard. Operators that are treated unfairly by cities will have a distinct disadvantage compared to other operators.

Based on the expert interviews, almost all Norwegian and Danish cities are operator neutral. In one city in Norway there has probably been one instance of digging permit "queue jumping" where one operator has received preferential treatment over others. We were not able to identify other examples of non-operator neutrality in Denmark and Norway.

Sweden is different. As opposed to the situation in Denmark and Norway, most Swedish municipalities have significant telecom interests. From the late 1990s to 2005 more than 150 municipal fiber-based networks ("Stadsnät") were built with the help of national grants. The majority of these networks are wholly owned by the municipality.

The Stadsnät have three primary business models: Passive infrastructure, active infrastructure ("Kommunikationsoperatör"), and service provider as can be seen in the figure below.

Figure 20 - Overview of the Swedish Broadband Business Model



Source: Open Universe

Some networks, such as Stokab in Stockholm, handle only passive infrastructure. They build, own, and rent dark fiber. Some networks, such as Stokab, have transparent and non-discriminatory terms and conditions, but some do not. We know that several cities consistently discriminate between operators. Since many municipality-owned networks do not disclose all terms and conditions it is difficult for outsiders to investigate, we think the fact that these terms are not publicly available is a problem in itself.

Some networks operate active infrastructure in addition to the (passive) fiber network. They operate interconnect points where service providers get access to the network, and they maintain web portals with retail pricing information for end users. Again, in some cases, the Kommunikationsoperatörs have been accused of discriminatory terms and conditions. This is particularly tempting in the third business model where the Stadsnät itself is a service provider in addition to the roles as network owner and Kommunikationsoperatör. For the purpose of

the study, we divided operator neutrality into two parts. Firstly, we focused on fiber operator neutrality and secondly we focused on where the municipalities are in the value chain and gave scores accordingly.

The Swedish national government is aware of the challenges outlined above and makes two important points about municipality-owned networks in the national broadband strategy²²:

- They should primarily sell dark fiber and access to ducts (and not compete with other operators higher up in the value chain)
- The networks should be accessible on operator-neutral and non-discriminative terms and conditions

6.2.4 Role in network deployment and operations

We believe that municipalities that understand the importance of network deployment usually take a more active role in ensuring that the inhabitants get better mobile and fixed networks. We therefore asked the following questions to or about the municipalities: Do you have a digging information system (such as “K-Grav” in Oslo)? Do you dig your own ducts and do you let other operators get access to the ducts? Do you have your own fiber and do you give other network operators access to the fiber?

Digging information systems

Many municipalities have understood the importance of a digging information system where they force the network operators to co-ordinate their digging in the area. When a network operator would like to dig a duct, they have to ask all the other network operators if they want access to the same duct. When the digging is done, then the municipality will deny digging in the same area/duct for a time period of three to five years. This ensures that the people living in the municipality do not have to live with their city being constantly dug up. Almost all of the Danish and Norwegian municipalities had a digging information system. In Sweden six municipalities does not offer this.

Duct deployment

Under duct deployment, we asked the municipalities if they deployed their own ducts. There are substantial differences between the three countries: none of the Danish municipalities dug their own ducts, some of the Norwegian municipalities did, while many of the Swedish municipalities did.

Duct and fiber rental

Given that duct rental is linked to duct deployment, we found the same result for duct rental. None of the Danish municipalities rented out ducts, very few of the Norwegian municipalities did, while the practice was more common in Sweden. The situation is similar with regards to fiber rental.

²² Source: Bredbandsstrategi för Sverige, November 2009

Appendix A: The Nordic Broadband City Index 2014

Figure 21 - The Nordic Broadband City Index 2014

Rank	Municipality	Country	Services	Mobile	Fixed	Final score	Included in 2012?
1	Linköping	Sweden	8,0	5,3	7,1	6,8	✓
2	Västerås	Sweden	8,4	5,2	6,3	6,6	✓
3	Kristiansand	Norway	8,8	5,2	5,6	6,5	✓
4	Bodø	Norway	6,2	7,5	5,4	6,4	✓
5	Tromsø	Norway	6,7	6,6	5,7	6,3	✓
6	Borås	Sweden	6,1	7,5	5,0	6,2	✓
7	Skien	Norway	6,5	6,2	5,8	6,2	✗
8	Göteborg	Sweden	6,6	5,1	6,8	6,2	✓
9	Asker	Norway	8,9	5,2	4,0	6,0	✓
10	Uppsala	Sweden	5,4	4,7	7,4	5,8	✓
11	Norrköping	Sweden	6,2	6,5	4,7	5,8	✓
12	Bergen	Norway	8,2	4,3	5,0	5,8	✓
13	Stockholm	Sweden	8,0	3,3	5,9	5,8	✓
14	Trondheim	Norway	9,1	4,1	3,8	5,7	✓
15	Drammen	Norway	6,8	4,9	5,0	5,6	✓
16	Bærum	Norway	9,1	3,8	3,8	5,5	✓
17	København	Denmark	8,8	3,5	4,3	5,5	✓
18	Esbjerg	Denmark	8,2	4,0	4,3	5,5	✓
19	Odense	Denmark	7,8	4,2	4,3	5,5	✓
20	Herning	Denmark	8,2	3,8	4,3	5,4	✓
21	Frederiksberg	Denmark	8,4	3,6	4,3	5,4	✓
22	Horsens	Denmark	7,6	4,9	3,7	5,4	✓
23	Randers	Denmark	7,9	3,8	4,3	5,3	✓
24	Oslo	Norway	6,6	4,7	4,7	5,3	✓
25	Århus	Denmark	8,5	2,8	4,3	5,2	✓
26	Umeå	Sweden	4,1	6,1	4,9	5,0	✓
27	Roskilde	Denmark	6,0	4,8	4,3	5,0	✓
28	Viborg	Denmark	7,1	3,7	4,3	5,0	✓
29	Stavanger	Norway	8,5	3,1	3,3	5,0	✓
30	Örebro	Sweden	5,9	4,4	4,3	4,9	✓
31	Helsingør	Denmark	5,9	4,4	4,3	4,9	✓
32	Silkeborg	Denmark	7,1	2,9	4,3	4,8	✓
33	Fredrikstad	Norway	6,6	4,7	3,1	4,8	✓
34	Vejle	Denmark	6,9	3,7	3,7	4,8	✓
35	Sandnes	Norway	8,0	2,5	3,5	4,6	✓
36	Helsingborg	Sweden	5,0	5,1	3,7	4,6	✓
37	Eskilstuna	Sweden	4,8	2,5	6,4	4,6	✗
38	Malmö	Sweden	4,4	3,1	6,2	4,6	✓
39	Aalborg	Denmark	6,3	3,0	4,3	4,5	✓
40	Sarpsborg	Norway	7,2	2,8	3,6	4,5	✗
41	Kolding	Denmark	5,8	3,4	4,3	4,5	✓
42	Skedsmo	Norway	5,8	2,5	4,4	4,3	✓
43	Jönköping	Sweden	3,5	2,8	3,4	3,3	✓

Source: Nexia DA

Score from NBCI 2014							
Included in 2012?	Municipality	Country	Services	Mobile	Fixed	Final score	Rank
✓	Linköping	Sweden	8,0	5,3	7,1	6,8	1
✓	Västerås	Sweden	8,4	5,2	6,3	6,6	2
✓	Kristiansand	Norway	8,8	5,2	5,6	6,5	3
✓	Bodø	Norway	6,2	7,5	5,4	6,4	4
✓	Tromsø	Norway	6,7	6,6	5,7	6,3	5
✓	Borås	Sweden	6,1	7,5	5,0	6,2	6
✗	Skien	Norway	6,5	6,2	5,8	6,2	7
✓	Göteborg	Sweden	6,6	5,1	6,8	6,2	8
✓	Asker	Norway	8,9	5,2	4,0	6,0	9
✓	Uppsala	Sweden	5,4	4,7	7,4	5,8	10
✓	Norrköping	Sweden	6,2	6,5	4,7	5,8	11
✓	Bergen	Norway	8,2	4,3	5,0	5,8	12
✓	Stockholm	Sweden	8,0	3,3	5,9	5,8	13
✓	Trondheim	Norway	9,1	4,1	3,8	5,7	14
✓	Drammen	Norway	6,8	4,9	5,0	5,6	15
✓	Bærum	Norway	9,1	3,8	3,8	5,5	16
✓	København	Denmark	8,8	3,5	4,3	5,5	17
✓	Esbjerg	Denmark	8,2	4,0	4,3	5,5	18
✓	Odense	Denmark	7,8	4,2	4,3	5,5	19
✓	Herning	Denmark	8,2	3,8	4,3	5,4	20
✓	Frederiksberg	Denmark	8,4	3,6	4,3	5,4	21
✓	Horsens	Denmark	7,6	4,9	3,7	5,4	22
✓	Randers	Denmark	7,9	3,8	4,3	5,3	23
✓	Oslo	Norway	6,6	4,7	4,7	5,3	24
✓	Århus	Denmark	8,5	2,8	4,3	5,2	25
✓	Umeå	Sweden	4,1	6,1	4,9	5,0	26
✓	Roskilde	Denmark	6,0	4,8	4,3	5,0	27
✓	Viborg	Denmark	7,1	3,7	4,3	5,0	28
✓	Stavanger	Norway	8,5	3,1	3,3	5,0	29
✓	Örebro	Sweden	5,9	4,4	4,3	4,9	30
✓	Helsingør	Denmark	5,9	4,4	4,3	4,9	31
✓	Silkeborg	Denmark	7,1	2,9	4,3	4,8	32
✓	Fredrikstad	Norway	6,6	4,7	3,1	4,8	33
✓	Vejle	Denmark	6,9	3,7	3,7	4,8	34
✓	Sandnes	Norway	8,0	2,5	3,5	4,6	35
✓	Helsingborg	Sweden	5,0	5,1	3,7	4,6	36
✗	Eskilstuna	Sweden	4,8	2,5	6,4	4,6	37
✓	Malmö	Sweden	4,4	3,1	6,2	4,6	38
✓	Aalborg	Denmark	6,3	3,0	4,3	4,5	39
✗	Sarpsborg	Norway	7,2	2,8	3,6	4,5	40
✓	Kolding	Denmark	5,8	3,4	4,3	4,5	41
✓	Skedsmo	Norway	5,8	2,5	4,4	4,3	42
✓	Jönköping	Sweden	3,5	2,8	3,4	3,3	43

Source: Nexia DA

Appendix B: Score Progression 2012 - 2014

Figure 22 - Nordic Broadband City Index Score Progression 2012 – 2014

Score Progression 2012-2014						
Country	Municipality	Services	Mobile	Fixed		Final score
Sweden	Linköping	1,8	0,6	0,0		0,8
Sweden	Västerås	2,6	-1,0	0,9		0,8
Norway	Kristiansand	0,9	-0,2	0,4		0,4
Norway	Bodø	2,9	-1,0	0,1		0,7
Norway	Tromsø	1,2	1,0	0,8		1,0
Sweden	Borås	-0,2	1,2	-0,4		0,2
Sweden	Göteborg	2,8	-0,1	0,9		1,2
Norway	Asker	0,9	0,2	-3,0		-0,6
Sweden	Uppsala	1,9	-1,4	3,2		1,2
Sweden	Norrköping	3,1	-0,3	-1,3		0,5
Norway	Bergen	0,2	-0,6	0,0		-0,1
Sweden	Stockholm	-0,4	-1,2	0,0		-0,5
Norway	Trondheim	2,6	-0,9	-0,8		0,3
Norway	Drammen	0,6	0,8	0,1		0,5
Norway	Bærum	2,6	0,6	-0,1		1,0
Denmark	København	0,7	0,2	0,0		0,3
Denmark	Esbjerg	0,9	-0,7	-0,3		-0,1
Denmark	Odense	0,2	-0,3	-0,3		-0,1
Denmark	Herning	2,9	-0,7	0,0		0,7
Denmark	Frederiksberg	-0,2	0,3	-0,3		-0,1
Denmark	Horsens	1,8	0,4	-0,7		0,5
Denmark	Randers	-0,1	0,4	0,0		0,1
Norway	Oslo	1,1	0,8	0,8		0,9
Denmark	Århus	-0,2	-0,6	-0,3		-0,4
Sweden	Umeå	-1,0	-0,4	-0,5		-0,6
Denmark	Roskilde	-0,9	0,1	0,0		-0,3
Denmark	Viborg	0,5	-0,5	-0,3		-0,1
Norway	Stavanger	2,9	-2,6	-1,7		-0,5
Sweden	Örebro	0,5	-2,6	0,4		-0,6
Denmark	Helsingør	-2,2	-0,2	0,0		-0,8
Denmark	Silkeborg	-0,9	-1,1	-0,3		-0,8
Norway	Fredrikstad	1,3	-0,1	-0,8		0,1
Denmark	Vejle	-0,4	-0,8	-1,0		-0,7
Norway	Sandnes	2,4	-0,5	-1,5		0,1
Sweden	Helsingborg	2,1	-1,6	0,4		0,3
Sweden	Malmö	1,8	-2,8	1,4		0,1
Denmark	Aalborg	1,6	-0,8	-0,3		0,1
Denmark	Kolding	-0,8	-1,4	0,0		-0,7
Norway	Skedsmo	1,3	-1,3	-0,6		-0,2
Sweden	Jönköping	0,0	-2,2	-0,4		-0,9

Source: Nexia DA

Appendix C: Questions to construction companies

1. What is the name of your company? [Click here to enter text.](#)
2. What is the name of the municipality you work with? [Click here to enter text.](#)

A. Mobile infrastructure

3. Does the municipality you work with allow access to public grounds and buildings for mobile infrastructure such as antennas and masts?
 - They do not allow such access
 - They allow access only in rare instances
 - They normally allow such access to some types of municipal buildings
 - They normally allow such access to all municipal buildings
 - Not sure
 - Other – please comment: [Click here to enter text.](#)
4. How easy do you find it is to work with the municipality on a scale from 1-10? [Click here to enter text.](#)
5. How effective is the municipality in regards to getting applications approved?
 - The municipality takes forever to get applications approved
 - The municipality usually takes quite a while to get applications approved, but they try their best
 - The municipality have short waits and a can do attitude
 - Not sure
 - Other – please comment: [Click here to enter text.](#)
6. Mobil masterplan – do you think the municipality have a plan or policy for the rollout of mobile infrastructure in the municipality?
 - No, they do not
 - Yes – the plan / strategy contains a spatial regulation for mobile purposes
 - Yes – the plan / strategy contains guidelines for application, planning and rollout for mobile infrastructure
 - Other – please comment: [Click here to enter text.](#)

B. Fixed infrastructure

7. Does your municipality allow the use of microtrenching along public roads?
 - Yes
 - They are currently testing microtrenching
 - They have not received any requests or applications for microtrenching
 - No they do not allow microtrenching
 - Other – please comment: [Click here to enter text.](#)

8. Telecom lines are sometimes deployed along telephony or electricity poles. What pole policy does the municipality have? (Check all that applies)
- They generally allow the deployment of new telecom poles
 - They generally allow new lines in existing poles
 - They generally do not allow the deployment of new telecom poles
 - They generally do not allow new lines in existing poles
 - Other – please comment: [Click here to enter text.](#)
9. When building new communications networks, it is often necessary to dig a trench along public roads. What are the requirements regarding trench depths along a suburban, low-traffic road where the annual average daily traffic is less than ca. 1 500? Hvor fleksible er de i forhold til forandringer i graveregler?
- The distance from road surface to the top of the cable casing should be 39 cm or less
 - The distance from road surface to the top of the cable casing should be between 40 cm and 59 cm
 - The distance from road surface to the top of the cable casing should be 60 cm or higher
 - Other – please comment: [Click here to enter text.](#)
10. When building new communications networks, it is often necessary to dig a trench across a public road. When crossing a suburban, low traffic road with a telecom trench, what are your requirements regarding *the width* of the road that needs to be resurfaced?
- They have no specific width requirements for resurfacing
 - The area that needs to be resurfaced should in general be up to 1 meter wide on each side of the trench
 - The area that needs to be resurfaced should in general be between 1 and 5 meters on each side of the trench
 - The area that needs to be resurfaced should in general be more than 5 meters on each side of the trench
 - Other – please comment: [Click here to enter text.](#)
11. If a telecom operator digs and resurfaces an area that is 8 meters wide and 6 meters long, what would the total municipal fees be in such a situation?
- The total fees would be: [Click here to enter text.](#)
 - Other – please comment (or enclose a copy of the relevant price list for such services): [Click here to enter text.](#)
12. Does the municipality (or a company that the municipality partners with) maintain a system for digging information that is available to communications network operators? (For example Kgrav in Oslo)
- No
 - Yes

Please comment on usage and completeness of information in the system: [Click here to enter text.](#)

Does the system have information about empty ducts? [Click here to enter text.](#)

13. Does the municipality (or a company that the municipality owns or partners with) deploy public ducts when a trench is opened along a public road? Er det kommunen som legger tomme rør til eget bruk?
- No
 - Yes – sometimes
 - Yes, always or almost always
 - Other – please comment: [Click here to enter text.](#)
14. Does the municipality allow access to municipality-owned ducts or fiber to communications network operators?

Ducts:

- They do not allow access to ducts
- They sometimes allow access to ducts
- They always allow access when ducts are available

Fiber:

- They do not allow access to fiber
- They sometimes allow access to fiber
- They always allow access as long as there is fiber available
- Other – please comment: [Click here to enter text.](#)

15. If the municipality allows access to fiber/ducts to telecom operators, do they have similar terms and conditions (for similar services) to all operators?

- They do not rent access
- They have similar terms and conditions to all operators
- They have different terms and conditions to different operators
- Other – please comment: [Click here to enter text.](#)

16. Have you seen a change in working with the municipality over the past few years?

- I think the municipality has gotten better
- I do not believe there has been a change
- I think the municipality has gotten worse
- Other – please comment: [Click here to enter text.](#)

17. Other comments you might have about the municipality?

Please comment: [Click here to enter text.](#)