Nordic Broadband City Index

How cities facilitate a digital future

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About this report

The Nordic Broadband City Index has been prepared by Marit Wetterhus and Harald Wium Lie at Nexia DA on behalf of Telenor ASA and IKT-Norge in the period from January to May 2012.

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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. Nexia´s clients include vendors and solution providers, investors and financial institutions, operators and service providers, authorities and governments. Nexia´s strength is their interdisciplinary competence and the staff's operational experience from telecommunications, ICT infrastructure and technology. Nexia DA also provides expertise in finance, technology, markets and products.

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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 or IKT Norge. 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.

Content

1 Background and summary

Introduction

Europe has set a path to growth and new jobs by enhancing digital services and the digital industry. Young people must get a new chance in new industries, seniors and disabled citizens must rely on location services with high accuracy and coverage, around the clock. The Nordic countries, already among the most digitalized societies in the world, continue to pursue aggressive digital strategies. Denmark, Sweden and Norway aim at no less than full digitalization of public communication with citizens. That bold vision calls for a closer look and scrutiny on the roles of cities in Digital Europe.

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.

In the coming years, demand for fixed and mobile capacity will grow rapidly. This is good news: the evidence is fairly conclusive that increased use of high-speed networks drives economic growth[1]. However, the price and coverage of high-speed mobile and fixed networks will depend to a large extent on network deployment costs.

That is why this study is dedicated to gaining insight into how local municipalities facilitate mobile and fixed network deployments. In addition, 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.

Methodology and data collection

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? We also met with representatives of IKT-Norge and talked to broadband engineers. 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. In total, the Index consists of 23 variables across three categories.

Afterwards, we collected data from a number of sources. The most important sources were municipal web sites and strategies (for the service part) and local engineering contractors (for the network facilitation parts). In addition, we organized a municipal survey and analyzed mobile site

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

information from Telenor. We identified the 50 largest municipalities in Norway, Sweden and Denmark as survey objects, and gathered complete information from 43 of these. In total they represent 35 % of the Scandinavian population.

Main findings

They can all do better

Although the Nordic countries have some of the world's best broadband networks and public digital services, there is a significant upside potential in all three areas that we surveyed. The average score across all municipalities and categories was 5,2 out of 10.

Municipal online services received the highest average rating (6,0), while mobile network facilitation scored 5,0 and fixed network facilitation ended up with a total score of 4,8. The low score on the city facilitation of fixed networks is of double concern, since fixed networks will play an important part in both high-speed fixed services like digital TV and streaming, but also play a vital role in connecting new, high-speed mobile networks. Services, end-users and municipalities all depend on infrastructure that connects them.

In our view, none of the larger Nordic cities we studied have a consistent, strategic approach to the full scope of policies needed to realize the potentials of Digital Europe. But some have clearly set out on a new direction with a clear strategy for many aspects of digital facilitation. Especially, some Norwegian and Swedish cities reveal a quite holistic understanding of digital needs and policy requirements. Some cities simply seem to be more ready for their digital future than others.

However, telecom and utility operators and engineers aren't 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 double 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.

There are large variations between (and sometimes within) municipalities

Scores varied greatly between municipalities. For example, for public online services we find that Sweden has both one of the highest-scoring cities (Stockholm, at 8,4) and the lowest-scoring city. The same is true for Norway in mobile network facilitation: the city of Bodø had the highest score (8,2) while two other Norwegian cities are at the bottom of that list.

We have also found variations within the same municipality. For example, three different sources told us that one specific city (a) never allows microtrenching, (b) sometimes allow microtrenching, and (c) always allow microtrenching. There are probably several reasons for this, but it is clear that individual city employees are not always in sync with each other regarding the interpretation of local rules.

Denmark has smaller differences between cities than Norway and Sweden. Danish cities have benefited from national leadership in the development of online public services. Also, Denmark has more consistent rules for fixed network deployment than the other countries. Unfortunately, in our view, they are consistently bad.

Public services: generally good, Denmark best

In general, Nordic cities offer a broad range of digital services to their inhabitants. Almost all cities support online daycare applications, most cities have interactive "fix-my-street" services, and digital invoicing is widely available. The Danish average score is the highest. Many Danish cities:

- Have enabled secure communication so that inhabitants can share sensitive information in digital channels
- Use and promote digital invoicing
- Have developed excellent public services
- Have had strong national support and standards

We found substantial variations among municipalities on the ICT strategy side. While most cities publish their ICT strategy, only a selected few describe the important relationship between ICT infrastructure and services. A likely consequence of this is that many ambitious service delivery plans will be delayed or cancelled due to lack of infrastructure. For example, GSM-based sensors are an important part of many e-Health and welfare services. A successful deployment of such services will require high quality mobile coverage. However, the city of Oslo no longer has a mobile X-ray machine available due to the municipality's rejection of base station applications.

Mobile network deployment: becoming more difficult

There are noticeable differences between countries with regards to mobile network deployment. In Sweden, ⅓ of Telenor's mobile masts and antennas are placed on public property. In Norway and Denmark, the shares are 15 % and 22 % 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. Norwegian lease costs are more affordable, at least when compared to the (high) general level of real estate prices, but several municipalities have placed restrictions on the placement of mobile infrastructure on public buildings.

Fixed infrastructure: generally difficult

Better fixed networks are necessary in order to realize future mobile and fixed services. It is therefore disappointing to see that most Nordic 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.

Only a few cities allow microtrenching which is an environmentally friendly, fast and cost-effective method for network deployment. Most municipalities have in our view 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 become commercially unattractive for rollouts.

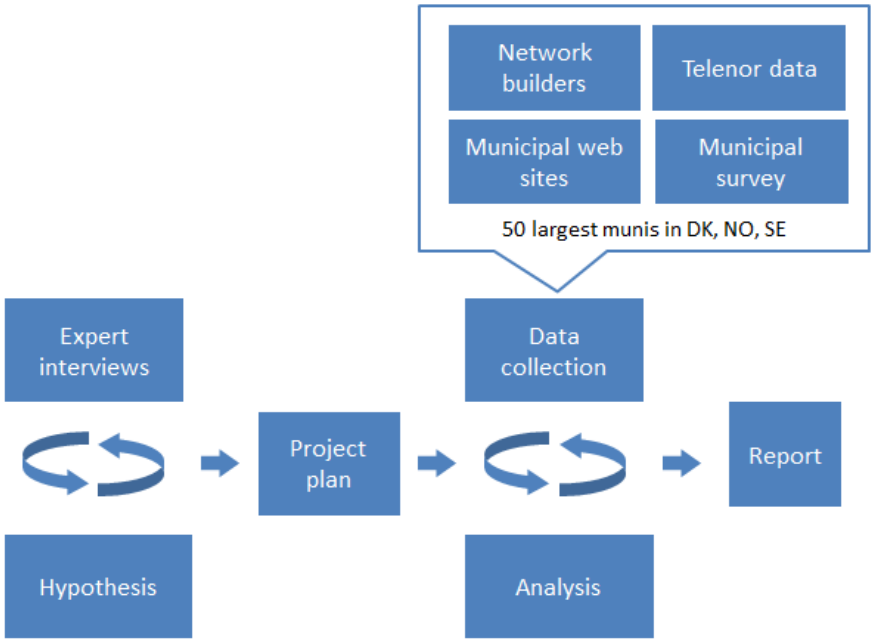
Sweden has a much higher level of public network deployment than Norway and Denmark. Several Swedish cities, e.g. Stockholm, allow affordable access to extensive fiber networks, which is clearly beneficial to network operators and their users. Other Swedish cities and public network owners, however,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

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: 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.

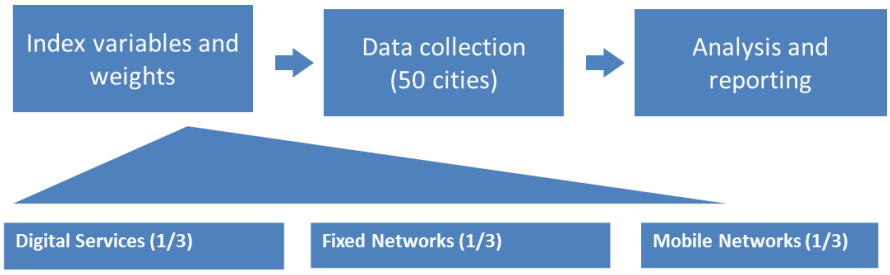
Figure 1. Project plan



Source: Nexia DA

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 ⅓ of the total NBCI. The difference between fixed and mobile infrastructure is decreasing as all networks are becoming fiber-based networks. Still, we decided to make the differentiation between the two as shown in Figure 2.

Figure 2. Methodology



Source: Nexia DA

We worked with experts at Telenor and IKT Norge to identify variables in each category. We had the following criteria in mind when selecting variables:

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

For online services we tried to choose services that represented different levels of complexity in order to be able to distinguish the best municipalities from the not-so-good municipalities. For fixed and mobile networks we identified the most important measureable factors when building and maintaining a network.

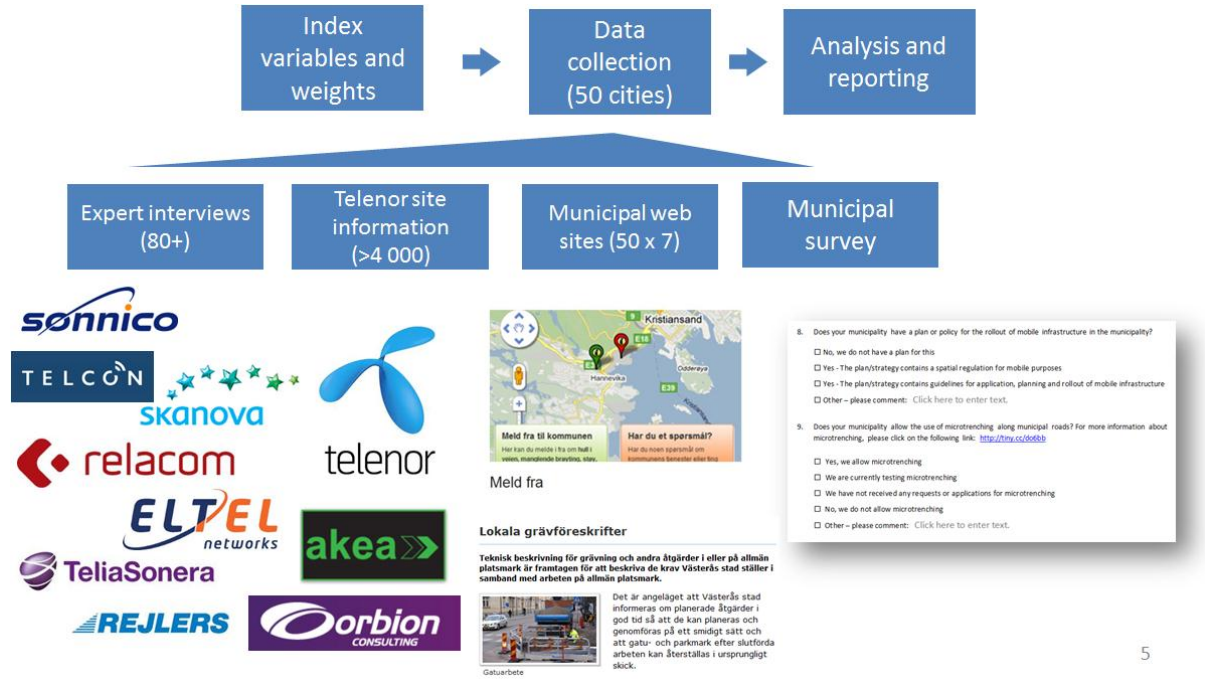
Once we had decided on the different variables, we made a "gold standard" for each variable. All municipalities were then measured against this standard and graded accordingly. The weights and variables for each category will be described in more detail later in the report.

The municipalities were chosen based on size. We selected the 50 largest municipalities in Denmark, Norway and Sweden, and gathered complete information from 43 of these. In total they represent some 35 % of the Scandinavian population. The NBCI consists of 15 municipalities from Denmark, 15 from Norway and 13 from Sweden. The municipalities and their scores are outlined in Appendix A.

2.2 Data collection

We collected data from a number of sources. The most important sources were municipal web sites (for the service part) and local contractors (for the network facilitation parts). In addition, we organized a municipal survey and analyzed site information from Telenor. The data was collected over a period of 4 months and from several sources, as can be seen from the figure below.

Figure 3. Data sources



Source: Nexia DA

2.2.1 Municipal web sites and general web searches

In order to collect data on the services offered by the municipalities, we used their web sites extensively. The web search was performed three different times in order to ensure the data was as robust as possible. When we found error messages we checked again several times. The web searches were performed primarily in the period January to March 2012.

2.2.2 Network building contractors and consultancies

In order to get an opinion on how it is to work with the respective municipalities in the NBCI, we performed in-depth interviews with the telecom contractors and consultants who regularly work with the municipalities. We tried to identify the actual people who do the work in each municipality, and thanks to employees at the following companies we were able to obtain input from several sources for most municipalities in Norway, Sweden and Denmark:

ElTel Networks	Relacom	Orbion Consulting	Telcon
Sønnico	Rejlers	Global Connect	Akea

2.2.3 Expert Interviews

In addition to the local contractors we had additional interviews with experts who work directly with the municipalities. TeliaSonera and Skanova in Sweden contributed greatly to the Swedish part of the study since it was hard to obtain the data we wanted from other sources in Sweden. We also talked to people from Post- og teletilsynet in Norway and IKT Norge. Telenor were also a great contributor of information and it would not have been possible to perform this study without the support of experts at Telenor Norway, Telenor Denmark and Telenor Sweden.

2.2.4 Telenor site analysis

We obtained site information from Telenor's Nordic operations. For every site in the relevant municipalities we obtained the following information:

- Site type (property for masts or rooftop access)
- Site ownership (municipal, other public, private)[2]
- Yearly site lease costs

2.2.5 Municipal surveys

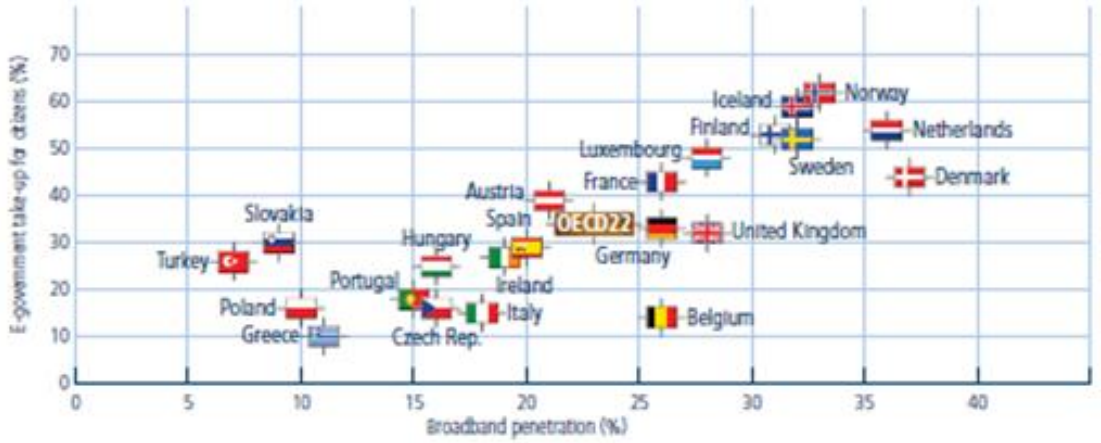
A municipal survey was made and sent out to 60 municipalities in Denmark, Norway and Sweden. The municipalities were followed up when they had questions to the survey and they were given one month to answer. The number of responses we received from the municipalities were not impressive and may reflect the lack of urgency and importance they feel in the area of fixed and mobile network deployment.

[2] The Danish data did not differentiate between municipal and other public sites.

3 They can all do better

The Nordic countries have some of the world's best broadband networks and public digital services. If we look at the relationship between broadband penetration and citizen uptake of e-government services for 2008, we see that the Nordic countries did quite well (see Figure 4 below).

Figure 4. Relationship between broadband penetration and uptake of e-government services



Source: OECD Broadband statistics & Eurostat (2008)

In the United Nations E-Government readiness ranking from 2008 the three top positions were occupied by Sweden (1st), Denmark (2nd) and Norway (3rd). In this year's rankings (see Figure 5 below), Denmark came fourth, Sweden seventh and Norway eighth. Although the results are not as strong as in 2008, all Nordic countries are world class.

Figure 5. E-government development index

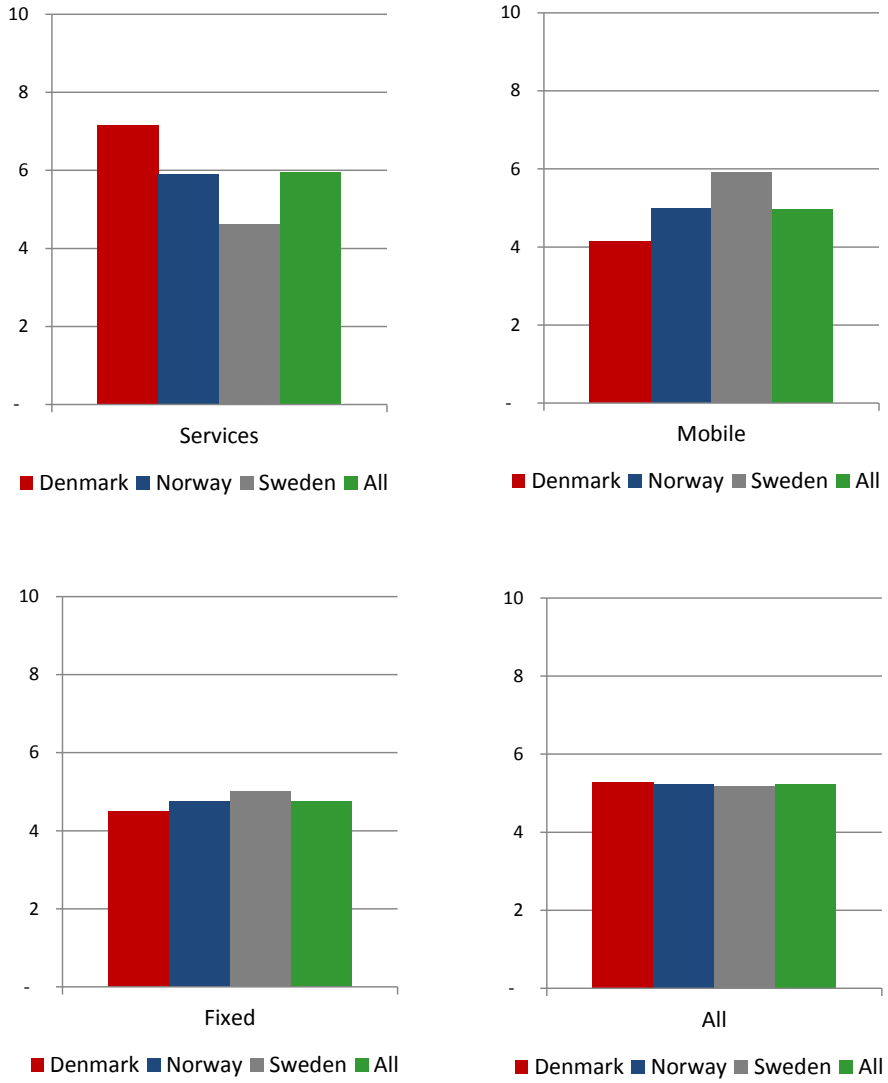
Rank	Country	Index Value	Online Service Component	Telecomm. Infrastructure Component	Human Capital Component
1	Republic of Korea	0,9283	1,0000	0,8356	0,9494
2	Netherlands	0,9125	0,9608	0,8342	0,9425
3	United Kingdom	0,8960	0,9739	0,8135	0,9007
4	Denmark	0,8889	0,8562	0,8615	0,9489
5	United States	0,8687	1,0000	0,6860	0,9202
6	France	0,8635	0,8758	0,7902	0,9244
7	Sweden	0,8599	0,8431	0,8225	0,9141
8	Norway	0,8593	0,8562	0,7870	0,9347
9	Finland	0,8505	0,8824	0,7225	0,9467
10	Singapore	0,8474	1,0000	0,6923	0,8500
11	Canada	0,8430	0,8889	0,7163	0,9238

Source: United Nations E-Government Survey 2012

Still, we have found that there is substantial room for improvement at the municipal level. The "gold standard" that we created for the different services in the NBCI entails a score of 10 for each

category (services, mobile, fixed and total). As can be seen from Figure 6 below, the municipalities on average have a substantial improvement potential.

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



Source: Nexia DA

Several municipalities did quite well, with Asker, Stockholm, and Kristiansand receiving the highest total scores. An interesting finding is that the best Danish municipality only came eleventh overall, even though Denmark had the highest average score (7,2) on services. Danish municipalities have come a long way on services and most Swedish and Norwegian municipalities have a lot to learn from their Danish counterparts. In services, Norway came second and Sweden third.

However, tables have turned in the mobile area. Swedish municipalities have the highest average score, followed by Norway. Danish cities get the lowest mobile score, first of all due to the very high site costs in Denmark. For fixed network facilitation, there were small differences in the average score obtained by the three countries.

In our view, none of the larger Nordic cities we studied have a consistent, strategic approach to the full scope of policies needed to realize the potentials of Digital Europe. But some have clearly set out

on a new direction with a clear strategy for many aspects of digital facilitation. Especially, some Norwegian and Swedish cities reveal a quite holistic understanding of digital needs and policy requirements. Some cities simply seem to be more ready for their digital future than others.

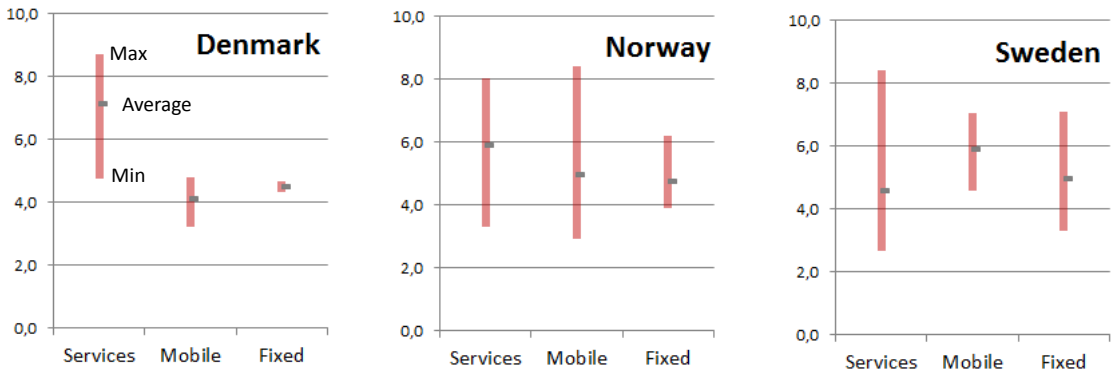
At the same time, the cities have to deal with a large number of network engineers and operators, who often employ different standards and levels of responsibility for the quality of their work. Some cities have encountered un-coordinated, and often defunct, digging and deployment practices that have tended to alienate citizens and local authorities. Best practice cities, such as Stockholm and Asker, have spent a great deal of effort securing co-operation, co-ordination and responsibility among cable owners and engineers. Sometimes, this has led to grievances and tension among industry players, while city authorities strive to balance societal needs. The high-scoring cities have a deliberate and strategic approach to infrastructure, which often is the result of political processes. Cities such as Stockholm and Asker have increased their focus on infrastructure issues within the framework of local democracy.

3.1 Large variations between (and within) municipalities

3.1.1 Denmark is more homogenous

As outlined in the figure below, the Danish scores show less variation than Sweden and Norway.

Figure 7 - Great variations



Source: Nexia DA

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 (Stockholm, 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 8,2 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. In addition, they all apply certain national platforms for online services. This underlines the importance of national goal-setting, and the interrelationship between the national and local level in digitalization.

3.1.2 Local rules and variations within the municipalities

We also found several municipalities that had clear sets of rules and regulations applied them inconsistently. For example, three different sources told us that one specific city (a) never allows microtrenching, (b) sometimes allow microtrenching, and (c) always allow microtrenching. There are probably several reasons for this, but it is clear that individual city employees are not always in sync with each other regarding the interpretation of local rules.

This made it sometimes difficult for us to assign scores to some of the municipalities, but it makes it even more difficult for the network operators who must deal with these municipalities. It also means that relationships to specific employees in the municipalities are important because it is the municipal case handler who determines to a great extent whether an operator will get the necessary permits or not. In a lot of cases the people we interviewed had experienced challenges if the personal chemistry did not work with the municipal employee.

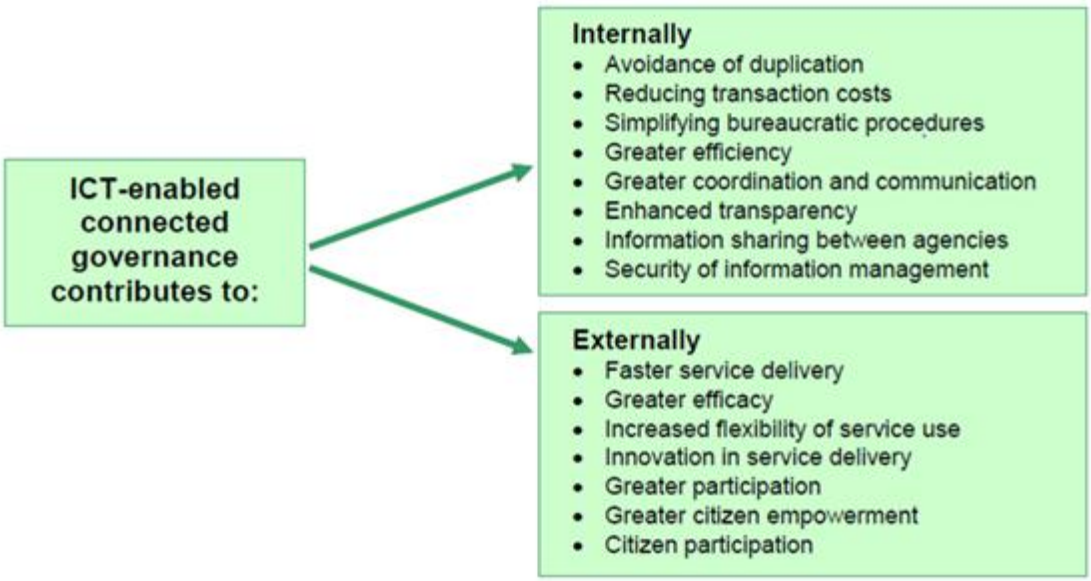
4 Public services: generally good, Denmark best

Of the three focus areas, public online services received the highest scores. The average score across all countries was 6,0 out of 10, with Danish municipalities having an average of more than 7.

4.1 Background for choosing services in the Index

We decided to include 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 as outlined in the figure below.

Figure 8 - ICT enabled connected governance

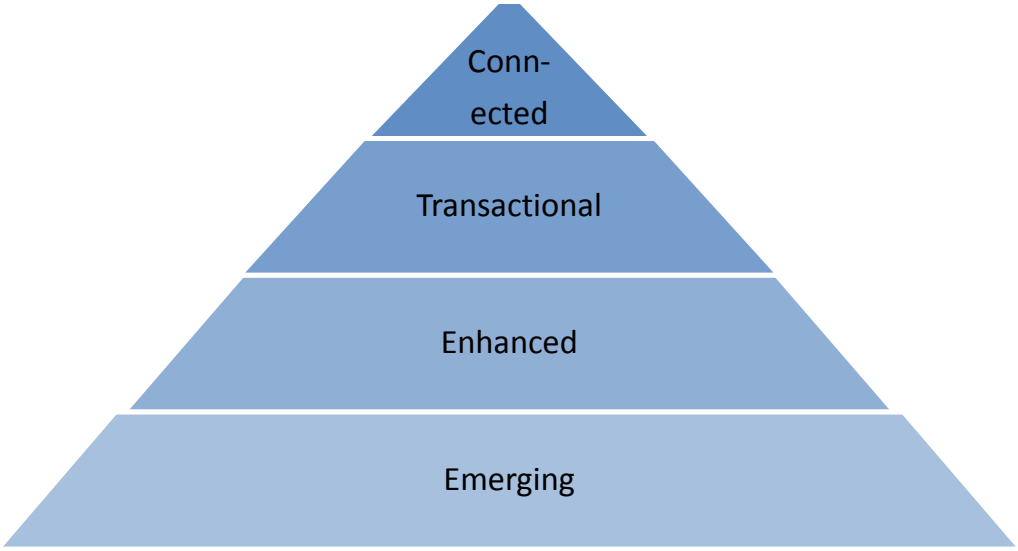


Source: E-Government for better government – OECD e-government studies.

Second, services can provide an indication of how sophisticated a municipality is in terms of how high it scores on the UN's Web Measure Index as outlined in Figure 9 below.

The first phase relates to things we would consider typical for an emerging presence in the internet, providing information that is limited and basic. The second stage is enhanced presence, where the municipality provides greater public policy and governance sources of current and archived information. Examples would be policies, laws and regulation, reports, newsletters, and downloadable databases. The third stage, transactional presence, allows a two-way interaction between the citizen and the municipality and can include options of paying for services, applying for ID cards, license renewals and other similar services allowing citizens to submit these online 24-7. The fourth and final stage is called connected presence and can be characterized by all interaction between the citizen and municipality being electronic.

Figure 9 – Phases of Web Measure Index

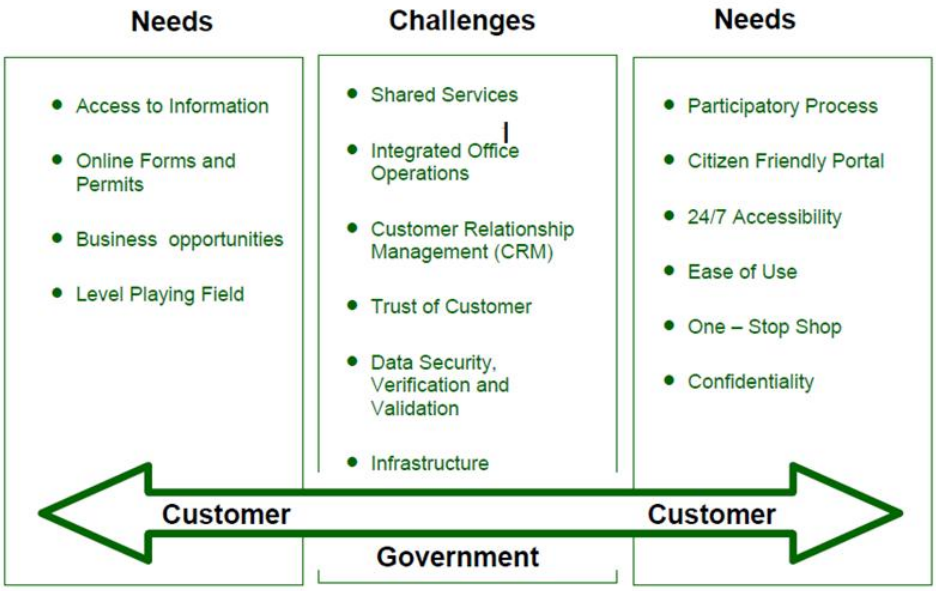


Source: United Nations E-Government Survey 2012

The services of the municipalities were assessed by a thorough search on each municipality's website, including the central portal, e-services portal and e-participation portal, as well as other related and relevant websites. In addition to being assessed for content and features, the municipal sites were tested for a minimal level of web content accessibility and user-friendliness.

Third and finally, the services can also be seen from an e-Government perspective where many of the challenges that a municipality faces are outlined in the ICT strategy as well as linking the services to the infrastructure as outlined in the figure below.

Figure 10 - E-government model



Source: United Nations

4.2 Variables and weights

The services part of the index is a composite of the six different indicators, with each indicator given a weight depending on its importance as outlined in Figure 11 below.

Figure 11. Digital municipal services

Area	Low score	High score	Weight
The presence of an ICT strategy	Not or only partly present	Comprehensive , updated, followed up	30
The availability of certain digital services to citizens			
• Online application / selection in areas such as daycare and residential building permit	Not available	Available, easy-to-use	10 + 10
• Online feedback/reporting for "Fix my Street" functionalities	Not available	Available, high functionality	15
• Digital invoicing and documents	Not available	Available & promoted	17,5
• Secure communication with public authorities	Not or partly available	Available & promoted	17,5

Source: Nexia DA

4.2.1 ICT strategy

ICT Strategy was chosen as the most 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 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 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?

Municipalities that impressed with comprehensive ICT strategies were Asker, Bærum and Bergen in Norway, Stockholm and Linköping in Sweden, and Fredriksberg, København and Århus in Denmark.

We did, however, find great variations among municipalities and some of them did not have their ICT strategies available online at all. Given that both Stockholm and København did very well in this area, we were surprised to find that large cities such as Aalborg, Uppsala and Oslo do not have an ICT strategy available online[3].

4.2.2 Online daycare application

Online Daycare application is a widely available service. With the exception of four Swedish municipalities, 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.

4.2.3 Online building permits

This category clearly showed that the Danish and Norwegian municipalities have focused on online building permit application. 12 out of 15 Danish cities had the service, and the same is true for 13 of the 15 Norwegian municipalities. The Swedish municipalities however have not had the same focus, as only 2 of the 13 Swedish municipalities obtained top score in this section.

4.2.4 "Fix-My-Street"

With "Fix-My-Street", we are moving up on the service development pyramid outlined in Figure 9. Here we are looking at feedback/reporting and we found a lot of different "Fix-My-Street" systems in our search. Some municipalities have a full-fledged solution while others still only offer telephone and/or e-mail.

We found that many systems gave the inhabitants the possibility of giving 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 an online feedback from the municipality when the issue was taken care of or fixed. Excellent examples were seen in København and Vejle in Denmark, Stockholm in Sweden and Trondheim, Stavanger, Bærum, Kristiansand, Tromsø, Drammen and Larvik in Norway. It is clear that Norway had focused on this service since many municipalities received the highest score in this category.

4.2.5 Digital invoicing

Digital invoicing is also a service in the transactional part of the service pyramid outlined above. 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 was offered by all the Danish municipalities surveyed. The Danish municipalities therefore all received a perfect score. The Swedish municipalities also received a respectable overall score since a lot of municipalities offer digital invoicing. The

[3] Or at least not one that we could find after rather extensive searches.

Norwegian municipalities, on the other hand, have a large improvement potential. Some Norwegian municipalities offer digital invoicing, but Norway was the only country where some of the municipalities did not offer digital invoicing at all.

4.2.6 Secure communication

Denmark provided back in 2007 a strong guidance in terms of requiring 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.

Norwegian and Swedish municipalities have a long way to go before they all get full score on secure communication. There are some municipalities that receive top marks, such as Stockholm and Fredrikstad, but very few municipalities offer fully secure communication services to their inhabitants and a lot of municipalities have not even planned for such a service.

4.3 Main findings – digital services

When summing up and rating all the different services we looked at for all the municipalities in Scandinavia, Århus (DK), Fredriksberg (DK) and Stockholm (S) came out on top. These municipalities all displayed high scores in almost all of the different categories of digital services and a showed a solid understanding of the importance of digitalizing services. Denmark came out at the top of the list (see Figure 12 below) receiving the top scores overall and four of the top five municipalities are Danish. It is also interesting to note that apart from Aalborg none of the Danish municipalities score less than 5,3, which is high compared to the Norwegian and Swedish municipalities. The Danish municipalities had an average score of 7,2 which is the highest average score for all the 3 categories in the NBCI (services, mobile- and fixed infrastructures). The Norwegian and Swedish municipalities had average scores of 5,9 and 4,6 respectively for services. The low Swedish score was surprising and is linked to a relatively low score on ICT strategy (a lot of the ICT strategies were not available online), online building permit, Fix-My-Street and secure communication. Stockholm, however, scored very well. Borås, Linköping, Västerås, Örebro and Umeå all scored higher than 5, while half of the Swedish municipalities received a score of less than 4.

The Swedish municipalities were on the other hand best in terms of user-friendliness for disabled users, but that was not a part of the survey this time.

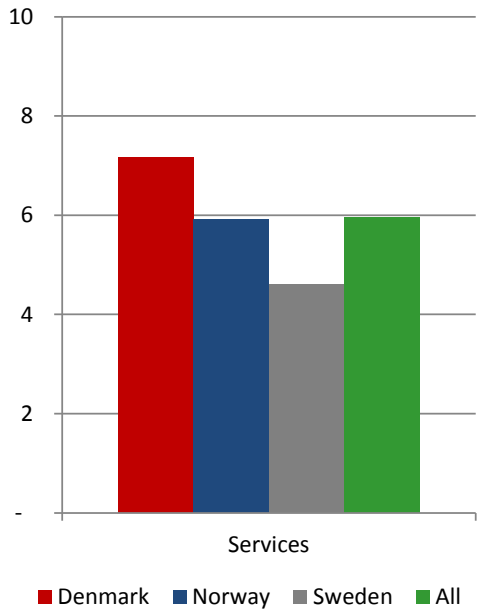
Figure 12. Overview – rating of digital services for all municipalities

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

Source: Nexia DA

The result shows that Denmark has an average of 7,2 for services compared to 5,9 and 4,6 for Norway and Sweden respectively. Denmark also has 6 municipalities in the top ten while Norway has 3 and Sweden only has one. 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 is boasting of having a lot of digitalized local services, and enlisted a substantial proportion of local citizens to use them. 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.

Figure 13 - Main findings - services



Source: Nexia DA

Why does Denmark score so much better than Norway and Sweden on services? We believe that some of the answers lie in the fact that Denmark has made significant changes in their municipal sector in recent years. The 2007 municipal reform ("Kommunalreformen") reduced the number of municipalities from 271 to 98. In addition, the Danish government has developed national standards ensuring that all municipalities have access to important services such as digital invoicing and secure communication. The municipalities themselves have also developed excellent public services. When reading ICT and channel strategies for the Danish municipalities it is very clear that they develop and introduce public services because they want to simplify life for their users and themselves. The Danish municipalities place much emphasis on making reforms and introducing new services to reduce costs. An example of this is Helsingør Municipality, who outline in their "kanalstrategi" the cost of communicating with their inhabitants the way they do today versus what they can save if they introduce electronic services.

5 Mobile network deployment: getting harder

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. The average mobile network facilitation score across all municipalities was 5,0, which is significantly lower than the 6,0 average for online public services.

5.1 Variables and weights

The variables, weights, and the "gold standard" for each element is outlined in the figure below. The 4 different elements together comprise the mobile component of the NBCI, which accounts for ⅓ of the total NBCI score.

Figure 14. 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

5.1.1 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 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 high scores were Lund (S), Bodø (N) and Tromsø (N), followed by 10 Swedish municipalities. The Norwegian cities of Oslo, Skedsmo and Sandnes had the lowest access scores.

5.1.2 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 site information for more than 4 000 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 Silkeborg (DK), Bærum (NO) and Fredrikstad (NO).

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 municipalities[4]. 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 lease costs are more affordable, at least when compared to the (high) general level of real estate prices.

5.1.3 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, we interviewed several sources per municipality, and where the grade given by the different experts differed, we used an average grade in the NBCI.

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 Stockholm scoring very well and København placing in the middle.

The municipalities that obtained the highest score on collaboration and effectiveness were Norrköping (SE), Kristiansand (NO) and Odense (DK), followed by Bodø (NO), Stockholm (SE) and

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

Malmø (SE). The municipalities with the lowest score were Helsingborg (SE), Århus (DK), Oslo (NO) and Bærum (NO).

Several of the network contractors, consultancies and other experts we talked 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.

5.1.4 Mobile master plan

For a mobile network builder, having clear rules and regulations is paramount since it makes 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.

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. In Norway, Bodø was the only city where our interviewees felt that the municipality has a clear plan in the area of mobile network deployment.

5.2 Main findings: mobile network deployment

In this component, the Danish municipalities had the lowest score (see Figure 15 below). The clear winner in mobile network facilitation was Bodø (NO). Bodø offers 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

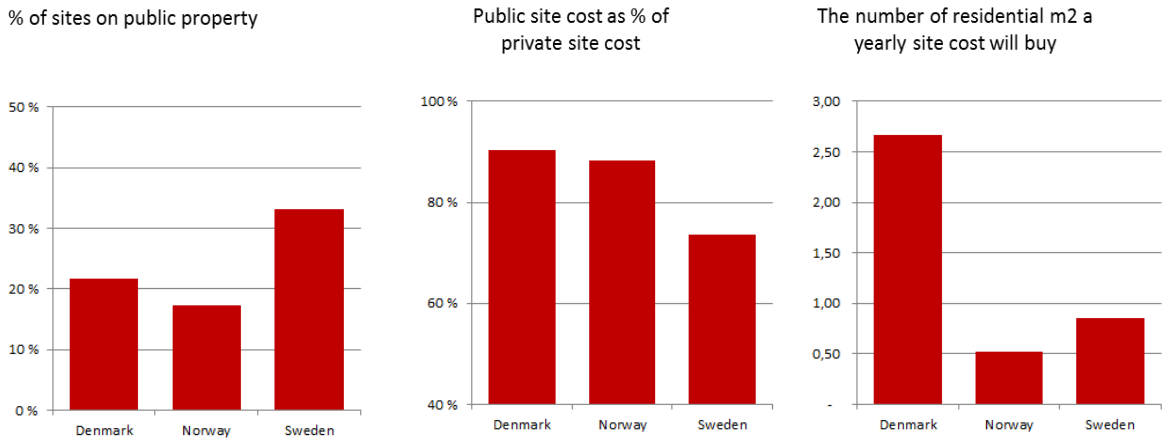
Sweden		Norway		Denmark	
Norrköping	6,8	Bodø	8,4	Kolding	4,8
Helsingborg	6,7	Sandefjord	6,6	Esbjerg	4,7
Örebro	6,6	Stavanger	5,7	Roskilde	4,7
Umeå	6,5	Tromsø	5,6	Helsingør	4,6
Borås	6,3	Larvik	5,4	Herning	4,5
Västerås	6,3	Kristiansand	5,3	Vejle	4,5
Uppsala	6,1	Asker	5,1	Odense	4,5
Malmö	5,9	Trondheim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

Source: Nexia DA

As opposed to online services, the results above show that Denmark has by far the lowest average score (4,1). Norwegian cities received an average score of 5,0 and the Swedish municipalities getting the highest average score of 5,9 for mobile network deployment. We also see the same trend as far as the municipalities represented in the top ten, with Denmark not having any municipalities in the top ten, Sweden having eight and Norway two cities.

The Danish municipalities all receive low scores in the mobile section of the survey due to the mobile site costs. It is expensive to lease mobile sites in Denmark compared to Sweden and Norway. This can be seen in Figure 16.

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 (33 %) than in Denmark (22 %) or Norway (17 %). It is interesting to note that the number of sites on public 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 is by far the highest with 90 %, Norway 88 % and Sweden 74 %. 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. Again 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.

6 Fixed network facilitation: generally difficult

Municipalities' ability to secure a smooth and reasonably flexible facilitation of fixed broadband development was the area with lowest overall scores. The average score for all municipalities is 4,8, well below the 5,2 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.

Variables and weights

The variables, weights, and the "gold standard" for each element are outlined in the figure below. The 4 different elements together comprise the fixed network component of the NBCI, which accounts for ⅓ of the total NBCI score.

Figure 17. 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) • Rents fiber to operators	No	Yes – on fair terms	

Source: Nexia DA

6.1.1 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 recently. While digging and re-instating the road for a traditional trench is a time-consuming and expensive exercise, the microtrench can avoid many 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-effective. We only found two municipalities allowing microtrenching, some more are currently testing it, but the large majority of municipalities decline microtrenching in their area.

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.

6.1.2 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, with only two Norwegian municipalities requiring less than 60 cm and one having a requirement of 80 cm. Sweden had even greater variations, and we saw everything from 40 cm to more than 90 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) until recently, and Lørenskog (not being a part of the index) is now the worst municipality of all the ones we have looked at with their requirement of 25 meters on each side of the duct. It is difficult to understand why digging in Lørenskog should require 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, while Norway had substantial variations. Tromsø, Larvik and Sandefjord do not have any fees at all. When talking to people in Tromsø, they stress that the municipality is happy that the network operators ensure the people living in Tromsø get access to a good broadband network. Furthermore, the municipality is also happy about the re-surfacing of the roads in their area. On the other end of the scale are Oslo, Oppegård and Skedsmo, which have the highest fees among the NBCI cities.

6.1.3 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.

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 at least one city consistently discriminate between operators. Since many municipality-owned networks do not disclose all terms and conditions it is difficult for outsiders to investigate, but 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 strategy[5]:

- 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

6.1.4 Role in network deployment and operations

After having spoken with several municipalities and experts in the field, 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

[5] Source: Bredbandsstrategi för Sverige, November 2009

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, then 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 3 to 5 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 Swedish municipalities had a digging information system. The Norwegian municipalities on the other hand have a longer way to go before they all 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.

6.2 Main findings for fixed network facilitation

The average score for the Danish municipalities for fixed network facilitation was 4,5, 4,8 for the Norwegian municipalities and 5,0 for the Swedish municipalities. As outlined in the figure below, there are few variations in Denmark with all the municipalities getting a low score, Norway has more variation, while Sweden has the most variation with scores over 7 to a little over 3.

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

Sweden	
Linköping	7,1
Norrköping	6,1
Göteborg	5,9
Stockholm	5,9
Borås	5,4
Västerås	5,4
Umeå	5,4
Malmö	4,7
Uppsala	4,2
Örebro	3,9
Lund	3,8
Jönköping	3,8
Helsingborg	3,3

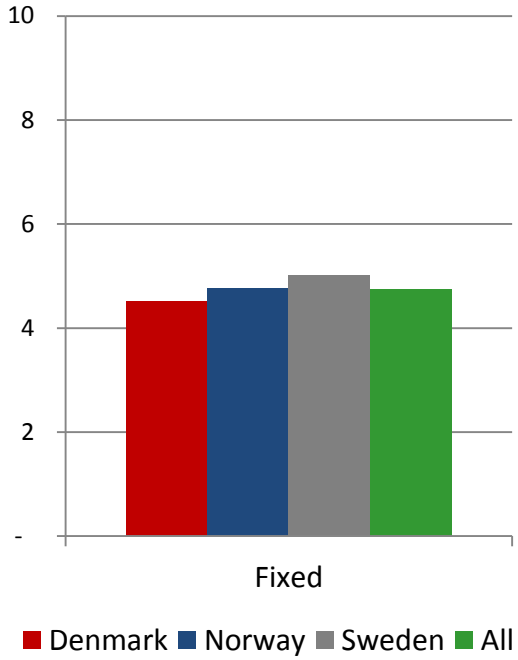
Norway	
Asker	7,0
Bodø	5,3
Kristiansand	5,1
Bergen	5,0
Stavanger	5,0
Sandnes	5,0
Skedsmo	5,0
Tromsø	4,9
Drammen	4,9
Larvik	4,7
Trondheim	4,6
Sandefjord	4,2
Fredrikstad	3,9
Bærum	3,9
Oslo	3,9

Denmark	
Århus	4,7
Aalborg	4,7
Odense	4,7
Esbjerg	4,7
Vejle	4,7
Frederiksberg	4,7
Viborg	4,7
Silkeborg	4,7
København	4,3
Randers	4,3
Kolding	4,3
Herning	4,3
Horsens	4,3
Roskilde	4,3
Helsingør	4,3

Source: Nexia DA

Linköping, Asker, and Norrköping received the highest fixed network scores, with Linköping and Asker receiving 7,1 and 7,0, respectively. Both Linköping and Asker display a good understanding of the importance of fixed network and broadband facilitation. The experts we interviewed believe that Linköping has offered good facilitation for a while, while Asker has improved considerably during the last years. Asker is strict and processes take some time, but according to the experts, Asker seem to genuinely try their best. Their focus on the environment has also opened for microtrenching, which increases Asker´s overall fixed network facilitation score. Both Linköping and Asker have invested in fiber networks which might influence their more positive attitude towards fixed network facilitation. The investment in fiber networks amongst the Swedish municipalities might also explain why Sweden has 7 municipalities in the top ten for fixed network deployment. They seem to offer better fixed network facilitation than both the Norwegian and Swedish municipalities. Norway has 3 municipalities in the top ten and Denmark does not have any. Due to a higher degree of national regulations, there is low variation among Danish cities compared with Norwegian and Swedish cities.

Figure 19 - Main findings - fixed



Source: Nexia DA

There is 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”. Both local governments and national policy makers should verify whether it is possible to revise these rules.

Appendix A: The Nordic Broadband City Index

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

Source: Nexia DA

Appendix B: The Municipality Survey

A. Digital services to residents in your municipality

1. What is the name of your municipality? Click here to enter text.

2. To what extent does your municipality offer digital invoicing to inhabitants for municipal services?

   ☐ We do not offer digital invoicing for municipal services to inhabitants

   ☐ We offer digital invoicing for some municipal services to inhabitants

   ☐ We offer digital invoicing for all or almost all municipal services to inhabitants

3. When requesting or applying for fee-based municipal services, do inhabitants get a discount or other benefits if they choose online application forms instead of traditional/paper-based methods?

   ☐ No, we do not have such policies

   ☐ Yes, we have discounts for some service areas

   ☐ Yes, we have introduced "digital discounts" in a number of service areas

4. When communicating with the municipality, can inhabitants choose an acknowledged secure communication method, for example NemID (Denmark), MinID (Norway), Bank ID (Sweden) etc.?

   ☐ No

   ☐ We offer (or require) secure communication for some municipal services

   ☐ We offer (or require) secure communications for most or all municipal services

5. Does your municipality have an IT/ICT strategy that is publicly available?

   ☐ No – we do not have an IT/ICT strategy

   ☐ No – we have an IT/ICT strategy but it is not publicly available

   ☐ Yes

6. How does your municipality evaluate performance according to the IT/ICT strategy?

   ☐ We do not have an IT/ICT strategy

   ☐ I am not aware of any evaluation of performance vs. the IT/ICT strategy

   ☐ We follow up the objectives in the IT strategy but we do not publish the evaluations

   ☐ Yes, we evaluate and publish performance vs. strategic IT objectives

B. Mobile and fixed line infrastructure in your municipality

7. Does your municipality allow access to municipal grounds and buildings for mobile infrastructure such as antennas or masts?

   ☐ We do not allow such access

   ☐ We allow access only in rare instances

☐ We normally allow such access to some types of municipal buildings

☐ We normally allow such access to all types of municipal buildings

☐ Other – please comment: Click here to enter text.

8. Does your municipality have a plan or policy for the rollout of mobile infrastructure in the municipality?

☐ No, we do not have a plan for this

☐ Yes - The plan/strategy contains a spatial regulation for mobile purposes

☐ Yes - The plan/strategy contains guidelines for application, planning and rollout of mobile infrastructure

☐ Other – please comment: Click here to enter text.

9. Does your municipality allow the use of microtrenching along municipal roads? For more information about microtrenching, please click on the following link: http://tiny.cc/do6bb

☐ Yes, we allow microtrenching

☐ We are currently testing microtrenching

☐ We have not received any requests or applications for microtrenching

☐ No, we do not allow microtrenching

☐ Other – please comment: Click here to enter text.

10. Telecom cables are sometimes deployed along telephony or electricity poles. What pole policy does your municipality have? (Check all that applies)

☐ We generally allow the deployment of new telecom poles

☐ We generally allow new cables in existing poles

☐ We generally do not allow the deployment of new telecom poles

☐ We generally do not allow new cables in existing poles

☐ We generally allow new and existing poles where duct digging is impossible

☐ Other – please comment: Click here to enter text.

11. When building new communications networks, it is often necessary to dig a trench along municipal roads. What are your requirements regarding trench depths along a suburban, low-traffic road where the annual average daily traffic is less than ca. 1 500?

☐ The distance from road surface to the top of the cable casing should generally be 39 cm or less

☐ The distance from road surface to the top of the cable casing should generally be between 40 cm and 59 cm

☐ The distance from road surface to the top of the cable casing should generally be 60 cm or higher

☐ Other – please comment: Click here to enter text.

12. When building new communications networks, it is often necessary to dig a trench across a municipal 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?

☐ We 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.

13. If a telecom operator digs across a suburban low-traffic road, 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.

14. Does your municipality (or an organization that the municipality partners with) maintain a system for duct and trench information that is available to communications network operators?

☐ No
☐ Yes

Please comment on usage and completeness of information in the system: Click here to enter text.

15. Does your municipality (or an organization that the municipality owns or partners with) deploy telecom/ICT ducts when a municipal road is constructed or maintained?

☐ No
☐ Yes – sometimes
☐ Yes – always or almost always
☐ Other – please comment: Click here to enter text.

16. Does your municipality allow access to municipality-owned ducts or fiber to communications network operators?

Ducts:

☐ We do not allow access to ducts

☐ We sometimes allow access to ducts

☐ We always allow access when ducts are available

Fiber:

☐ We do not allow access to fiber

☐ We sometimes allow access to fiber

☐ We always allow access as long as there is fiber available

☐ Other – please comment: Click here to enter text.

17. If your municipality allows access to fiber/ducts to telecom operators, do you have similar terms and conditions (for similar services) to all operators?
    ☐ We do not rent access

    ☐ We have similar terms and conditions to all operators

    ☐ We have different terms and conditions to different operators

    ☐ Other – please comment: Click here to enter text.

18. Does your municipality use smarthouse technologies (such as sensors that can measure wet beds, falls, or patient movements) in the area of elderly care?

☐ No, we do not

☐ No, but we have a smarthouse pilot project

☐ Yes, we use smarthouse technologies