Problem Description

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The Socioeconomic Impacts of Broadband Utilization in the Accommodation Sector in Norway

This Master's thesis is a continuation of last semester's specialization project "A Benchmark Study on Broadband Utilization" - where I undertook a research analysis of business uses and benefits of broadband services to assess the impacts of broadband for economic development.

This thesis will consist of two main parts:

The first is a follow-up process of the results that were gathered in the fall project - where contact will be made with some of the hotels that responded to the survey. They will be brought results on their broadband utilization that Strategic Networks Group (SNG) has calculated and generated based on their earlier answers. Then they will be aided in the process of gaining economic benefits based on this feedback.

The second part is to perform a second survey where research data will be collected directly from businesses and organizations within a defined geographic region. Research will once again focus on a specific industry or sector selected by the author. To collect data from these businesses, an established online questionnaire provided by SNG will be used.

The goal of the research and analysis is to benchmark the selected industry/sector on the current state of uses of broadband services and the benefits derived from broadband use. Results will be compared to equivalent data - provided by SNG – from similar research already conducted in the US. By doing this, a comparative analysis with the selected region will be performed, hereby providing an opportunity to assess gaps and opportunities for increased adoption of broadband-enabled services and economic development.

In addition to the collecting and analyzing of research data, research will be conducted on how broadband is deployed in the Norwegian community today, and how the rapid evolvement in the field of broadband technology can affect the community in a socio-economic point of view.

Assignment given: 16.02.2011

Supervisor: Harald Øverby

Abstract

Broadband technology has in recent years experienced a substantial growth, and is still rapidly evolving. Many new kinds of content-rich and bandwidth demanding broadband Internet applications have emerged, aiming to make day-to-day tasks easier and more efficient. A strong broadband connection provides the platform for an optimal broadband utilization, but equally important is the adapting and implementing of these Internet applications, or "e-solutions", so that broadband can lead to socioeconomic benefits for individuals, businesses and for a society as a whole.

This thesis reviews some of the areas where enterprises can utilize broadband opportunities in order to achieve social- and economic development. A broadband utilization benchmark study is carried out on a selection of geographical areas in the accommodations sector in Norway. By analyzing the recieved data from this research, this paper identifies gaps and opportunities for the increased adaption of broadband-enabled services and further economic development for the businesses. Also, by performing a comparative analysis between the data collected in the Norwegian research population and equivalent data from the US, similarities and differences regarding the two countries' utilization of the Internet are analyzed and discussed. Some important fields that are examined are broadband connectivity, barriers preventing the efficient use of broadband services, and the use of a selection of e-solutions.

Also presented is an independent calculation of a broadband utilization index, constructed with the thought of providing a quick representation of a company's use of the Internet and its applications. This calculation will be subject for analysis, so as to understand the construction and potential outcomes that are derived by changing the input data. Resulting in an output-utilization score, this calculation, the Stople-Index, is constructed to give companies and organizations an easy way to promote awarness and identify opportunities for them to utilize their broadband Internet properly.

Preface

This thesis serves as a Master's project in Telecommunications Economics in the 10th semester of the Master's Program in Communication Technology at The Norwegian University of Science and Technology, NTNU. As a topic provided by Strategic Networks Group (SNG), this is a continuation of the specialization project "A Benchmark Study on Broadband Utilization in the Accommodation Sector of the Hardangerfjord Area in Norway" that was completed in the Fall of 2010. It has been planned and carried out during the Spring of 2011 at NTNU Gløshaugen in Trondheim, Norway.

My appreciation is to be given to supervisor Thibaud Châtel, an Information Economics Consultant at SNG. His guidance during the last year, by sharing his knowledge and providing valuable input and regular feedback, has been of great value to this thesis. His experience has helped me form my perspective and develop the correct chain of thought necessary when carrying out this kind of study. Thank you to SNG for lending me their online benchmarking tools, supplying me with the necessary information from their research database and for aiding the fashion of the follow-up invitations. During the last year, M. Châtel and I have performed conference calls with CEO Michael Curri and VP of Operations Gary Dunmore at the SNG Headquarters in Ontario, Canada. Their knowledge has been of great assistance to me, and they were always very helpful. To that I am grateful.

Finally, I would like to thank Harald Øverby, Associate Professor at the Department of Telematics (NTNU) for his role as co-supervisor. His presence here at NTNU has been of great help, being able to assist me on short notice, as well as providing me with ideas so as to aid my progression during the course of this semester.

Trondheim, June 30, 2011

Steffen André Stople

Abbreviations

3GPP 3rd Generation Partnership Project

ADSL Asymmetric Digital Subscriber Line

AON Active Optical Network

CDMA Code Division Multiple Access

DEi Digital Economic index

DOCSIS Data Over Cable Service Interface Specification

EDGE Enhanced Data rates for GSM Evolution

EV-DO Evolution-Data Optimized

FDMA Frequency Division Multiple Access

FTTB Fiber To The Building

FTTH Fiber To The Home

GPON Gigabit Passive Optical Network

GSM Global System for Mobile communications

HDTV High-Definition TeleVision

HFC Hybrid Fibre-Coaxial

HSPA High Speed Packet Access

ICT Information and Communication Technology

LTE Long Term Evolution

MDF Main Distribution Frame

OECD Organization for Economic Co-operation and Development

PON Passive Optical Network

PWLAN Public Wireless LAN

SNG Strategic Networks Group

TDMA Time Division Multiple Access

UMTS Universal Mobile Communications System

VDSL Very-high-bitrate Subscriber Line

VoIP Voice over Internet Protocol

WiMAX Worldwide Interoperability for Microwave Access

Definitions

3GPP The 3rd Generation Partnership Project (3GPP) is the standards organization that is responsible for the evolutionary planning of the 3GPP family of technologies.

Broadband Penetration The term broadband penetration refers to the amount of the Internet-access market that high speed or broadband Internet has captured (Total subscribers / Total country population)

Capex, or Capital expenditures, are expenditures that are made to create future benefits

CDMA2000 is a family of 3G mobile technology standards, which use CDMA channel access - to send voice, data, as well as signaling data between mobile phones and cell sites.

DEI (Digital Economy Index) is a composite score, calculated by Strategic Networks Group (SNG) of how organizations use Internet-enabled applications, or "e-solutions", to drive efficiencies, innovation, and profitability.

A **DDoS** (denial-of-service) attack is an attempt by attackers to prevent legitimate users of a service from using a service, either by crashing or flooding the service

EV-DO (Evolution-Data Optimized) is a telecommunications standard for the wireless transmission of data through radio signals, typically for broadband Internet access. It is standardized by 3GPP2 as part of the CDMA2000 family of standards.

LTE (Long Term Evolution) is the project name of a new high performance air interface mobile communication systems.

Narrowband refers to a signal which occupies only a small amount of space on the radio spectrum, delivering speeds up to 56 kb/s

OECD is an international economic organization of 34 countries founded in 1961 to stimulate economic progress and world trade. It defines itself as

a forum of countries committed to democracy and the market economy, providing a setting to compare policy experiences, seeking answers to common problems, identifying good practices, and co-ordinating domestic and international policies of its members.

SNG's Broadband Lifecycle is a unique approach to each and every broadband initiative, and is a method used to create a platform for productivity, competitiveness and innovation not only for the business, but for the whole region as well

SNG's Digital Economy index (DEi) is a composite score of how organizations use Internet-enabled applications, or "e-solutions", to drive efficiencies, innovation and profitability.

UMB (Ultra Mobile Broadband) was the brand name for a project within 3GPP2 to improve the CDMA2000 mobile phone standard for next generation applications and requirements. In November 2008 it was announced that development of UMB was ending, with the lead sponsors favoring LTE instead.

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Chapter 1

Introduction

The term broadband is normally used to describe almost any "always on, high-speed connection to the Internet". In addition to being an important support for information flows in the economy, it also links together individuals, businesses and governments. Since the popularization of the Internet over dial-up connections in the 1980's and 1990's, the constant development of the underlying infrastructure has made broadband growth in recent years quite substantial. In fact, since December 2004, the number of broadband subscribers in the OECD[1]-countries has increased by a staggering 250%, reaching 295 million subscriptions as of June 2010 [21]. As a result, the online possibilities have been greatly increased, making it possible to integrate the Internet into many business processes and services, promoting social interaction and delivering multimedia content to a large number of users.

Infrastructure development is currently a very important topic in Norway, and much work is being done in the deployment of broadband access to the entire population - both in rural and urban areas. Equal access to the digital infrastructure for everyone, in all parts of the country, is important for both settlement and business life. For this reason, full broadband coverage of the nation has been an important goal in Norwegian broadband politics in recent years [27]. In a study carried out by the Norwegian Ministry of Government Administration and Reform in 2009, it is stated that 99.9% of Norway's households has acquired broadband coverage - when including mobile broadband. However, only 50% of the households had access to downstream capacities of more than 25 Mbit/s [Nex10a].

With the rapid evolution of broadband technology, there follows the possibilities to achieve a number of socioeconomic gains within a community. The upgrade to high-speed broadband connections can have an important role in modernizing many existing operations, making daily operations easier and as well as securing existing work-places. In addition, many new knowledge-based

[1]Organization for Economic Co-operation and Development (OECD) is an international foundation consisting of 34 countries, founded to stimulate economic progress and world trade

enterprises may find it easier to establish themselves, by utilizing online information, services and even computing power to make "the step" into an already highly competitive market. High-speed network access also diminishes geographical distances, thereby building the foundation for creating new competence-based workplaces throughout the entire country.

The introduction of a high-speed infrastructure is, however, not the only aspect that needs to be developed in order to achieve the social and economic benefits that broadband technology can introduce. Being able to use this technology in the correct way is also vital, which involves the importance of promoting both awareness and knowledge among consumers to be able to reap the benefits of an expanding network of Internet-based solutions.

As a result of introducing high-speed broadband Internet in a community, the effects are plenty. For instance, individuals may benefit from the modernizing of a local society by receiving better Internet- and TV-offers. For businesses and organizations, economic gains can be achieved by arranging effective videoconference-meetings as an alternative to hosting physical meetings. They can utilize Voice over Internet Protocol (VoIP) telephony, and they have the possibility of introducing teleworking, which is to let their employees work from their homes by using high-speed broadband Internet.

The opportunities are many, but the work and the preparations that have to be laid as a foundation, are essential in order to fully experience and achieve the entire range of benefits that are attainable. Careful planning should be made in advance of making the necessary initial investments, to make sure that the following benefits outweighs the initial costs. Building a underlying network, and supplementing with the necessary knowledge and expertise, is in any case the most important part of utilizing the potential that lies in todays broadband solutions.

1.1 Objectives

This project consists of two main parts. First, a research study on an industry/sector in a chosen geographical area is to be performed, both which are to be selected by the author. The responses that are received in this research are then to be analyzed and measured up against an already existing database provided by SNG, containing data from similar research performed in the United States of America.

Some background information is provided to ensure that the reader is updated on the current state of broadband technologies in Norway, as this is a quickly evolving field of technology. It is important to know both the limitations that the different broadband technologies represent. Also to be presented, are some of the economic and social benefits, in terms of e-Solutions and services, that broadband can bring to a society. With the results from the research analysis, I will attempt to assess potential gaps and opportunities for

increased adoption of broadband-enabled services and economic development in the chosen area. Having previously discussed the benefits of these services will provide the reader with a better insight and understanding of the analysis.

The second part of this project is a follow-up phase, where feedback will be given to selected businesses based on the results they submitted in the first part of this study. This work is mostly practical, but a description of the work that is done in this part is given in Section 3.5 in Chapter 3.

When looking at the results in this paper, several options and opportunities for profit realization, that can be achieved from exploiting the benefits of high-speed Internet will be discussed. These are important for the growth and economic realization in the business perspective, as well as for the development and life quality in the whole society.

During the course of this project, it became evident that some sort of broadband utilization calculation should be constructed. The reason for this is to create a method to analyze the received data from the survey responses, and to be able to easier assess gaps and shortcomings in a company's broadband utilization.

1.2 Method and Choice of Research Areas

This research study has its basis in the Lofoten- and Tromsø-area in the Northern part of Norway. More information regarding these areas, and the reason they were chosen for this study, will be given in Section 3.2.

After discussing and planning with Strategic Networks Group (SNG), the industry of choice selected for this research was the hotel- and accommodations-sector. This came as a natural choice, as this project is a continuation of the 2010 fall project[2]. Here, the same industry sector was chosen, but it had its geographical focus on the Hardangerfjord-area, Bergen and Oslo.

The reason for choosing this sector, is that tourism is an exiting field where the use of broadband can come into effect and bring positive economic- and social gains for businesses, the workers as well as the customers - and accommodation enterprises are clearly a part of the tourism industry. In co-operation with SNG, the following municipalities where chosen from this area of Northern Norway, with the intent of benchmarking accommodation enterprises located here on their current broadband utilization:

- Flakstad
- Moskenes
- Røst
- Tromsø

[2]"A Benchmark Study on Broadband Utilization in the Accommodation Sector of the Hardangerfjord Area in Norway" [Sto10]

- Vestvågøy
- Værøy
- Vågan

In addition to these municipalities, the decision was also made to include hotels and bed & breakfasts' situated in Oslo, the capital of Norway. Reasons for this choice were to add more depth to the research population, as well as following up the interest of benchmarking the accommodations in this sector in the largest city in Norway.

The collection of data in this research has been retrieved by using an online questionnaire, provided by SNG, and has been adjusted in order to fit the interest areas of the selected industry. This survey has been sent to the selected hotels, bed & breakfasts' and camping cites using e-mail, addressing them to the general managers or other employees with sufficient knowledge about the company's daily operations - therefore being in a position to answer the survey. Many of the hotels have IT-consultants that they have brought in, making these great candidates to answer on behalf of the hotel. For the ones that didn't reply on the first inquiry, reminder e-mail's were sent both two- and one week before the survey deadline. Also, during the time the survey was active, contacting the hotels by phone was also done to further inform about the project and improve the response rate.

1.3 This Project in the Media

Interestingly, this project has gotten attention in some articles and newsletters on Strategic Networks Groups' website. The project that was performed in the Fall of 2010 is mentioned in [13], with SNG introducing their partnership with the Norwegian University of Science and Technology (NTNU) and the author of the project, as well as giving a short review of the project's success.

As a result of the follow-up process in this Spring thesis, SNG has published an article [12] introducing Hotel Ullensvang and their IT-manager, Geir Midtun. In short, it describes how a hotel that is situated quite far from most of its clients and suppliers, has used its broadband connection to overcome the physical distances and thereby "connecting themselves to the world". This shows what impact the work that is carried out in this project can have in terms of hotels realizing the potential of their broadband utilization, as well as showing how some hotels already have grasped many of the promising opportunities that exist.

1.4 Contributions

The contributions in this paper are as follows:

- The *collection and subsequent analysis* of data regarding the utilization of broadband technologies and e-solutions. A broadband utilization benchmarking survey is carried out in this project, concentrating on the hotel- and accommodations sector in Norway. A *comparative analysis* between the Norwegian and US market in this sector is also performed.
- Actual *suggestions for improving the current utilization of Internet-based solutions*, based on survey responses from two selected accommodations, is presented and explained.
- *An independent broadband utilization calculation* is presented. Influenced by SNG's confidential DEi-monitor, this independent calculation, or *the Stople-Index*, is constructed with the view of making businesses aware of gaps and opportunities in their current broadband utilization - by providing an output score based on previously collected input data.

Important to notice, is that all figures that represent contributions in this paper are marked with [Stople, 2011]. This is in line with a document structure educated in the course "ENGR 103 - Advanced Engineering Writing" at the University of California Santa Barbara (UCSB) in California, USA.

1.5 Limitations

It is safe to say that the whole society can benefit from the use of broadband technology and the many solutions and services it introduces. As will be presented in Section 2.3, our society can be divided into three main parts: The private market, the communal- and government market and the business market. These markets are all presented in this paper, as a diversity of e-solutions and broadband services are used in all markets. This paper will, however, only focus its research study on the *business market*, as the choice was made to to benchmark businesses in the hotel- and accommodations-sector in Norway on their current broadband utilization. Thus, the presented results and subsequent analysis of the results from the SNG's e-Solutions Benchmarking Survey will only represent the enterprises within this sector - with following discussions and conclusions being made based on this data.

1.6 Document Structure

The remainder of this report is organized as follows. Introductorily, an insight in the Norwegian telecommunications-market is given, followed up by a brief account regarding the different access technologies that are used in todays market. The importance of describing these are simple: to be able to review economic- and social benefits related to broadband, knowing the terminology, characteristics and properties of the different technologies is essential in order

to tell them apart and measure them up against each other. Such properties may for instance be downstream- and upstream capacity, and range of operation. Information regarding the Norwegian market is included while discussing the technologies where it is seen relevant. The next section presents a number of social- and economic possibilities that can arise in a society as a result of the introduction of a broadband infrastructure. Subsequently, an introduction to the Canadian broadband specialist company Strategic Networks Group (SNG) is given, and a selection of their developed methods and online tools will be presented.

Following the background information, comes a description of the research procedure. This is a review of all processes that were part of the practical work in this project. The process of localizing the industry sector and geographical area, the survey modeling and the gathering of information from the chosen enterprises, are all described. Then, the results from the online e-Solutions Benchmarking Survey are reviewed, before discussing them thoroughly - diving deeper into some of the areas of broadband utilization.

The next chapter will describe a follow-up process that has been carried out during the course of this project, aiming to help selected accommodations on how to better utilize their broadband connection by taking into use various e-solutions. The hotels for this project were selected based on survey results collected in the specialization project during the Fall of 2010.

An independently calculated broadband utilization score is then presented, developed with the intention of providing businesses and organizations a feedback on their current state of broadband use. This calculation will be presented and reviewed alongside SNG's exclusively owned and developed e-Solutions utilization score - the Digital Economy index (DEi).

After concluding the results and findings of this study, a paragraph on potential future work on this thesis is given - revealing the author's thoughts and ideas regarding uncovered aspects of interest.

Additionally, the following appendices are included:

Appendix A: Access Technology in General

Appendix B: Contents of Attached Zip-File

Appendix C: SNG's DEi Scorecard

Appendix D: List of Accommodations

Appendix E: Invitation to the Follow-up Process

Chapter 2

Background

This chapter will introduce to the reader the underlying elements that are necessary in order for broadband Internet utilization to provide economic and social impacts on people, businesses or on a society as a whole. These fundamental aspects are displayed in Figure 2.1 so that their importance in this discussion are easily understood.

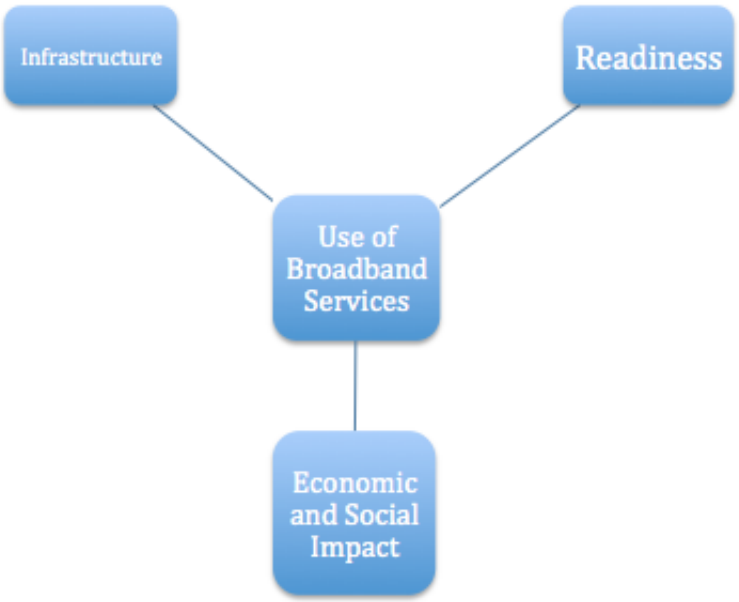


Figure 2.1: Conditions to achieve economic and social impact.

The technical infrastructure is the very backbone of broadband Internet utilization. Without an access technology connection, there is no Internet, and without Internet there can logically be no use of its services either. This chapter will therefore give an overview of certain broadband technologies and their status in the Norwegian market today, as well as comparing them to

current European standards. Theory related to access technology will also be presented. This includes the variety of technologies that are currently available as both wired- and wireless connections. An insight in each of these technologies' capacity, scalability and limitations is also provided. In addition, where it is considered relevant, the unfolding of these technologies in the Norwegian market will also be presented. The technologies behind two e-solutions are also mentioned when describing technology in general, so as to enlighten the reader on their underlying theory.

"Readiness" represents the human factors of the employees and the management of a company, and is a vital cog for the successful integration of broadband-based technologies into a company's operations. Although not dedicated an own section in this chapter, these factors will be mentioned regularly in this paper, substantiating the importance of this aspect in making optimal use of broadband services.

As the figure shows, fulfilling the two above-named conditions properly can lead to the efficient use of broadband services. We will in Section 2.3 look at some of the benefits that can be acquired from the use of these services . An increasing amount of services and possibilities are offered online as the capacity of broadband connections continue to grow, leading to new opportunities for economic- and social benefits. Being able to identify these opportunities is therefore essential.

The Canada-based, broadband specialist company Strategic Networks Group is a company that can help such an identification, and a presentation of their business is given in Section 2.4. They act as a contributor to this Master's project, by lending their specialized online tools and methods and providing market information. Having created an approach to best plan, build and track the development of broadband networks, a method called the Broadband Lifecycle, we will give present this cycle in Section 2.4.2 in this chapter. This is of extra interest since several steps of this cycle have been carried out in practice in this project.

2.1 Broadband in Norway Today

When speaking of Internet connectivity, Norway is one of the most advanced countries in the world, with high broadband penetration and excellent DSL coverage. They are also among the leaders in the deployment of the 4G/LTE technology. In fact, on the subject of wireless broadband, the only country in the EU that has a higher penetration of laptop-based wireless connections than Norway, is Luxembourg. According to the European Commission, the European Union is the largest broadband market in the world, and, although not an EU-member, Norway rank third among European countries when measur-

ing broadband penetration levels [1]. As stated in the European Commission's Europe's Digital Competitiveness Report from 2010, Norway score a broadband penetration of 34.5%. In comparison, the average of the 27 countries in the European Union is 22.8% and the US broadband penetration is 26.4%. [Com11].

Figure 2.2 shows the level of regular use of the Internet in Europe as of 2009, with "use" meaning that the users access the Internet at least once a week. With 88% of the population being regular users, and as many as 76% using the Internet every day, Norway is definitely in the very top of the European scale.

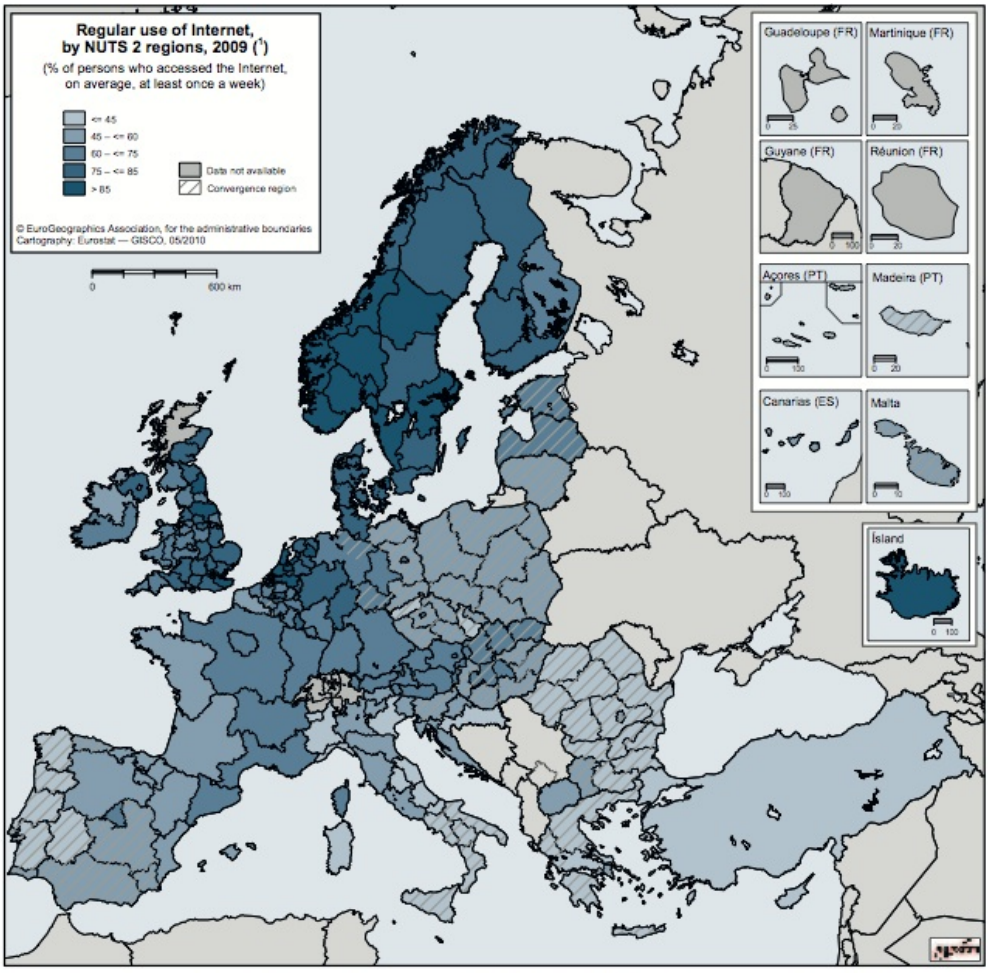


Figure 2.2: Regular use of Internet in Europe as of 2009 [Com11].

[1]The term broadband penetration refers to the amount of the Internet-access market that high speed or broadband Internet has captured (Total subscribers / Total country population)

At a global level, the growth in the broadband market has in recent years been driven by growth in developing countries, as many of them are currently doing great efforts on catching up with the leading countries. An example of this is the deployment of fibre-technology in Lithuania. Although not a developing country, Lithuania has never been considered in the elite of broadband deployment. However, as of February 2011, Lithuania tops the European Ranking with a 22.6% household penetration, followed by Sweden and Norway (both at 13.6%) [30].

By the end of 2010, there were 523 million broadband subscribers worldwide, which is an uprise of almost 12% from 467 million subscribers at the end of 2009 [PT10]. Of these, xDSL is the most popular access technology, used by over 331 million subscribers (63.4%). This is followed by cable modem, used by 106.4 million subscribers (20.3%), and fibre, used by 72.29 million subscribers (13.8%). An overview of the distribution can be seen below, in Figure 2.3.

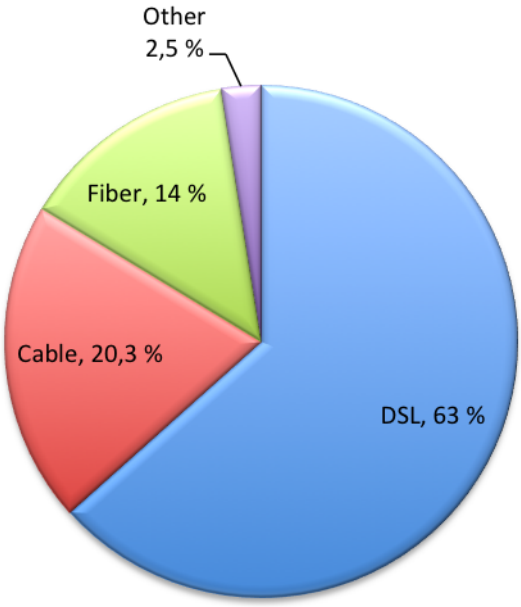


Figure 2.3: Worldwide distribution of fixed access technologies as of December 2010 [Stople, 2011].

Most of the broadband lines in Europe are based on xDSL technologies, and Norway is no different. As of June 2010, there were 1.65 million fixed (wired) broadband subscriptions in Norway, and approximately 60% of these were DSL connections. However, fibre-based technology is constantly gaining ground, and currently covers 14% of the market, making Norway one of the leading countries on the European fibre-market. This is verified in Figure 2.5.

Figure 2.4 displays the distribution of fixed access technologies in Norway as of June 2010. Just like the case is in Europe (Figure 2.5), DSL holds the

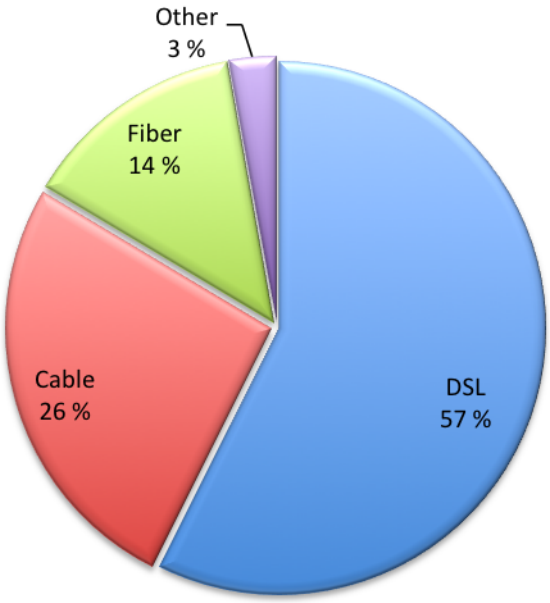


Figure 2.4: Distribution of fixed access technologies in Norway (June 2010) [Stople, 2011].

largest share, followed by cable and fibre-optic cables, respectively.

The Norwegian mobile broadband market is dominated by three operators - Telenor (with 61% of all subscribers), NetCom (24.3%), and ICE (8.2%). At the end of 2010, Norway was estimated to have about 5.65 million mobile subscriptions, accumulating a mobile penetration rate of 116% [oT11]. Despite not being saturated yet, the Norwegian market is getting close. However, as a way to continue to drive growth in the future, the Norwegian network operators will emphasize on the development of 3G, 3.5G and 4G technologies.

One 4G technology that is really putting on speed, is LTE[2], and the launch and subsequent development of 4G services based on the LTE technology is a very interesting development that has taken place in Norway's mobile market over the last few months. This makes Norway not only in the very elite when it comes to deploying fibre-to-the-home technology, but they are also among the more advanced nations in the European LTE-developments [11]. The worlds first commercial LTE network was actually launched in Oslo in December 2009, by NetCom/TeliaSonera, and demonstrated download peak rates of up to 150 Mbits/s. Meanwhile, in September 2010, Telenor elaborated on its preparations to introduce commercial LTE services as well. Both vendors aim to upgrade their whole mobile network by the end of 2011, by deploying new combined 2G/3G/4G networks in Norway. More information about the LTE

[2]LTE (Long Term Evolution) is the project name of a new high performance air interface mobile communication systems.

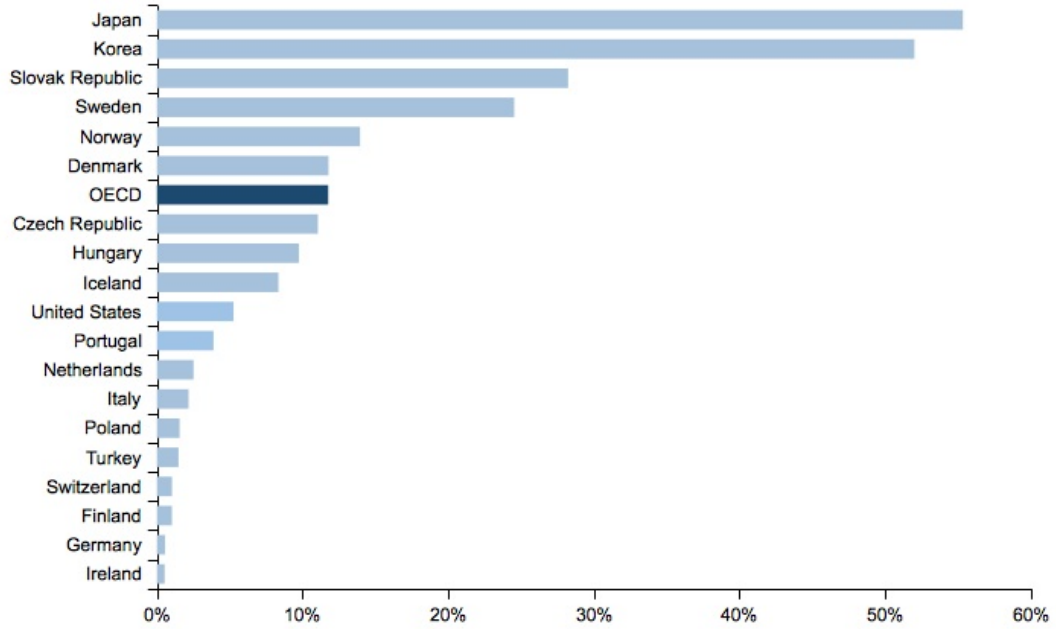


Figure 2.5: Regular use of Internet in Europe as of 2009 [Com11].

technology is reviewed in Section A.2.2. As the Norwegian government has committed itself to broadband expansions with regards to capacity, coverage and speed, the further development of services based on LTE will be essential. This area will enhance network capabilities significantly, and allow operators to extend their services to rural areas with lower capex [3].

As previously mentioned, the Norwegian telecommunications company Telenor is the incumbent operator in Norway, offering broadband, mobile and fixed wireless services. Based on total revenue from fixed telephony services, the operator remained the largest provider with a 70% share at the end of 2009. Telenor is also ranked as the sixth largest mobile operator in the world, with more than 195 million subscribers. This engagement in the world market, and with both Telenor's and NetCom's intent to invest heavily in the LTE technology undermines Norway's goal to maintain itself in the very elite when it comes to broadband communications in years to come.

Because access technologies plays such an important part when it comes to utilizing broadband solutions and -services, and as they are sure to have an even more important role in coming years, it is important to understand the levels that these can perform at in present time. The following section on Access Technologies (Section 2.2) will therefore enlighten the reader on the current state of both wired- and wireless technologies, as the understanding of their advantages and limitations will be important when discussing some of the benefits that broadband can bring to the society in Section 2.3.

[3]Capex, or Capital expenditures, are expenditures that are made to create future benefits

2.2 Technology in General

This section will first give an overview of the most used access technologies in the market today. However, only a brief summary of the original section will be laid out here. For the full description of these technologies, the reader is referred to Appendix A. Secondly, the underlying technology of two well-known online solutions is presented, namely Voice over IP and cloud computing, as preparation for later reading.

2.2.1 Wired- and Wireless Access Technologies

A broadband network can use different methods for transferring information through its final segment, which is the part between a unit placed at the customer end and one at the operators' closest node. Both these components contain senders as well as receivers, and different technologies can be used to send information between them. Threads of copper, coax or fibre are used for the cable-based technologies, while radio-waves sent through the air are used for the wireless solutions.

Common for all data-transfer technologies is that there exists physical limitations when it comes to how much data that can be transmitted. The size of the frequency spectrum, *the bandwidth*, decides the amount of information that can be transferred through a medium in a given space of time - setting *the capacity*. Other important aspects that can influence the bandwidth are: *the distance* between the sender and receiver, *the noise* on the transmitting channel, and (for wireless technologies) *the number of simultaneous users* utilizing the total network capacity.

We can divide broadband access technologies into two categories: Wired- and wireless access. Although developed to serve the same purpose, they each have their advantages and limitations.

Wired Access Technologies

Asymmetric Digital Subscriber Line (ADSL) was the first DSL technology to be set up in Norway, and it is still very widespread. Being an asynchronous technology, with a capacity of 6 Mbit/s downstream and 1 Mbit/s upstream, ADSL is best adapted for services such as information research, e-government and after-sale services. This is because the user in these cases will mainly be the receiver of data, and will manage these tasks with the bandwidth that ADSL can offer. As ADSL uses copper-cables, its capacity diminishes sharply when the length of the link increases. To be able to deal with the increasing demands of bandwidth capacity of online services, upgrades of the access network is therefore begun globally at a great scale.

A way to upgrade the ADSL network has been for network providers to replace their main feed in the local loop with fibre-optic cables - creating a

solution called *Very-high-bitrate-DSL (VDSL)*. Upgrading the network in this way leads to great additions in both the download and upload bandwidths, increasing to 52 Mbit/s and 12 Mbit/s, respectively. Services that before could not be performed with lower bandwidth, like video-conferencing and making large downloads, are now much more manageable.

The most future-proof solution is, however, to install *fibre-optic* cables all the way to the end user. Transmitting impulses of light through cables of optical fibre, this technology can theoretically transfer information from one place to another at speeds up to several Tbit/s - only depending on the technology being used at the connection point between two fibres [Com11]. As the loss of data transmission is close to neglectable when the length of the fibre-optic cable increases, this technology is very suitable for telecommunications networks in rural areas or for intercontinental communications.

A Hybrid Fibre Coaxial (HFC) network, the last wired technology to be described, is a technology that utilizes a combination of both fibre-optic and coaxial cable in different parts of a network to transfer the data content. The coax part of the network is often pre-deployed, as this is what we associate with the cable TV infrastructure. Being deployed in European countries in the 1980's, it is physically superior to the telephone infrastructure - as it was originally designed to carry large quantities of information. Utilizing this network is therefore a wise way to greatly upgrade the bandwidth in an area, as well as saving the expenses of replacing the network all-together.

Wireless Access Technologies

Originally designed to transfer voice, the development of mobile technologies have made them suitable of transferring data as well. Today, the bandwidth that can be provided by current mobile technologies is still lower than what can be offered by the best wired technologies, but the fact is that wireless technologies are quickly catching up with the wired solutions.

GSM (Global System for Mobile communications), also known as 2G, has been the most widespread wireless technology in the world since the 1990's. It has in recent years been upgraded to its next generation, called the *Universal Mobile Telecommunications Services (UMTS)* - or 3G. In Norway, the 3G network has again been upgraded from UMTS to a technology called *HSPA (High Speed Packet Access)*, which can offer data rates of 1-4 Mbit/s downstream and 0,5-2 Mbit/s upstream (compared to UMTS's 70-130 kbit/s synchronous bandwidth).

The wireless technologies just mentioned, makes it possible to perform very easy tasks on web-enabled mobile devices, but are hardly powerful enough to carry out any high-performance Internet solutions, and thereby replace the need for wired connections. This is where the *LTE (Long Term Evolution)* can make a change. LTE is a 4G technology that has been developed to meet the customers' increasing expectation of bandwidth, speed and global access.

Having a theoretical capacity of 160 Mbit/s downstream and 50 Mbit/s upstream, LTE is able to deliver higher-level services - like business applications, video and multimedia.

In order to provide broadband access to more rural areas, other wireless technologies can be utilized. *WiMAX (Wireless Interoperability for Microwave Access)* is a technology that allows for the data transfer over a radio link with a bandwidth of more than 50 Mbit/s over 20 to 100 km. Its future is, however, in certain doubt, as mobile carriers today are putting a lot of work into the LTE technology - making the latter the most likely option to become the standard for 4G.

Two other options to provide broadband wirelessly, is by a *fixed wireless* connection and by *satellite*. Both technologies can offer a somewhat unstable service, as their quality of service can adversely be affected by influences from nature, like rain or fog. Still, they are a great way to connect people in rural areas, where no infrastructure is available, with broadband technology.

2.2.2 Broadband Services

As the benefits of broadband services will be discussed later on in this paper, both in Section 2.3 ("Economic Benefits of Broadband in the Society") and in Chapter 4 ("Feedback the Hotels"), this section will describe in brief some underlying technical information that lead to some of these benefits. The technologies that will be discussed here are Voice over Internet Protocol (VoIP) and Cloud Computing.

2.2.2.1 VoIP

VoIP phone service (Voice over Internet Protocol) is a technology that replaces a traditional telephone line with a high-speed Internet connection. While the traditional service compresses a persons voice into a frequency and transmits it over a wire, VoIP compresses the sound of a voice into packets of data. The sending computer (or converter) sends the packet to a nearby router and then forgets about it. The nearby router sends the packet over the Internet to whatever router it finds is closer to the recipients computer. The packets are sent over the Internet, and eventually reach the receiving computer where they are converted back to sound. As the packets may take many different paths through the Internet, and arrive in a different order than they were sent, the receiving computer has to read the instructions that are contained within the packets to reassemble the data correctly into its original state. Because of this, it is a great advantage to use this service over high-speed broadband lines: they are more reliable and transfer data faster, and lead to less congestion over the network. This in turn means that fewer packets are lost along the way, and a "noisy" phone call will therefore be avoided.

Figure 2.6 shows how the VoIP technology sends digital information from the caller to the callee over the Internet:

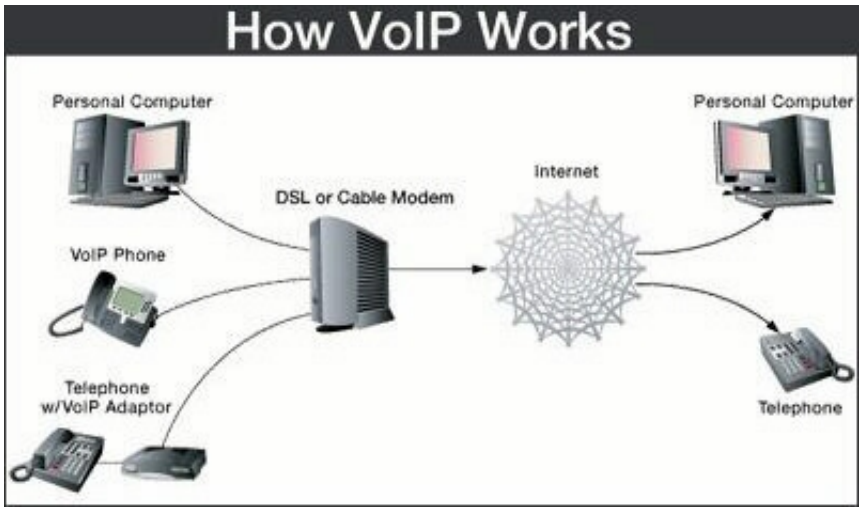


Figure 2.6: How VoIP works [18].

As the figure above shows, there are several ways to use the VoIP-service today:

- *Computer-to-Computer* is certainly the easiest way to use VoIP. All that is needed is installed software, a microphone, speakers and an Internet connection (preferably high-speed).
- *VoIP-Phones* connect directly to the router and have all the hardware and software necessary built-in in order to handle the IP call.
- *ATA* (Analog Telephone Adaptor) is an analog-to-digital converter. It takes the analog signal from the traditional phone and converts it into digital data for transmission over the Internet.

Most telephone carriers use VoIP today, as using high-speed broadband in the core network is the best way to carry the enormous amount of information that telephone services produce every day. However, what most people associate VoIP with is the use the technology through online applications - such as Skype.

Skype is a software application that is available for free download on the Internet, and that had as many as 663 million registered users in 2010 [29]. Calls to other users that have Skype installed, either on their personal computers or mobile units, are free, while calls to both traditional landline telephones and cell phones can be made for a fee using a debit-based user account system. Making the service even more popular is the possibility of file transfer, video conferencing and instant messaging.

What makes Skype different from and standard VoIP clients is that Skype operates on a peer-to-peer (P2P)[4] model, rather than the more usual client-server[5] model.

2.2.2.2 Cloud Computing

Simply put, cloud computing is a way of allowing users, no matter where they are, to obtain computing capabilities through the Internet from a remote network of servers. At the other end of the Internet-connection are so-called "computing-clouds", which are super-sized data centers containing tens of thousands of hosting web-servers.

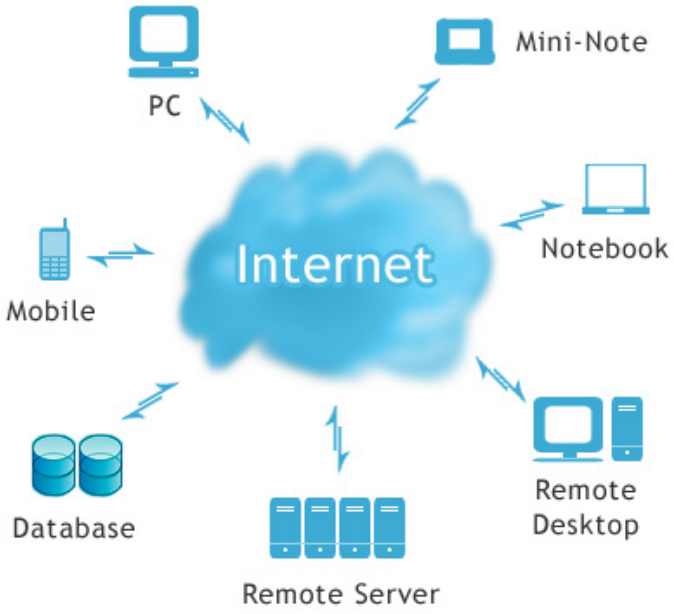


Figure 2.7: The basics of Cloud Computing [28].

Being an Internet based technology which stores information in servers, cloud computing can provide this information as an on-demand service. The service provider can use multiple remote computers in "the cloud" (a common shorthand for the cloud computing service) to obtain the required processing power to perform a task, which might be word processing, taking backup of large amounts of data, or computing intensive work.

[4]P2P networking is a distributed application architecture that partitions tasks or workloads between peers, and was popularized by file sharing systems like Napster.

[5]A distributed application structure containing server machines, that are hosts running one or more server programs, that share their resources with clients

2.3 Benefits of Broadband in the Society

After having described the the current level of broadband development in the society as of today, it is now time to introduce various ways in which broadband and the economy interact. Broadband and the Internet are rapidly becoming an integral part of the economy, and taking a look at different ways of utilizing broadband services will enlighten the reader on the potential and advantages high-speed broadband can bring to society - not only economically, but socially as well.

By the early 2000's, broadband was recognized as a key element of an information society and, around the world, governments developed strategies to encourage the development of broadband infrastructures that would enable high-speed network access for all citizens. The information society can be thought of as the way to get information from one place to another, and, as technology constantly gets more advanced, so too has the way we have adapted in sharing this information with each other. Recognizing these ways, and adapting to the new IT-technologies we get introduced to, makes us citizens of this society - Digital Citizens. In the world today, being a digital citizen is an absolute necessity in order to be able to reap the benefits that the Internet and broadband can offer in both the business world and life itself.

The use of broadband is an essential part of the market transformation that ICT (Information and Communications Technology) has induced, and the recent increase of investment in high-speed broadband has lead to to activities, both for personal- and business use, being performed "online". At the personal level, also denominated individual level, broadband technology has provided an easy way to connect to others, as well as making many everyday activities being done on the Internet. For the average population in Norway, the most popular online activities are: looking up information about goods and services, ordering goods and services, reading online newspapers and carrying out online banking [Com11].

Separate systems - like telephone, television and video and individual computer systems - have previously stored and transmitted voice and video data over different channels. As a result of the constantly evolving broadband technology, these systems are converging onto the Internet, leading to new and exiting opportunities in terms of innovation an communication for 21st century communities and their citizens. Demanding high broadband capacity, new kinds of Internet activity and content-rich media applications emerge, underlining the importance of continuous development and expansion of high-speed broadband.

Figure 2.8 describes three areas in a society where broadband technology can bring benefits: the private market, the business market and the communal- & government market. As can be understood of the figure, some broadband services bring benefits mostly to one market area, while others "overlap" into

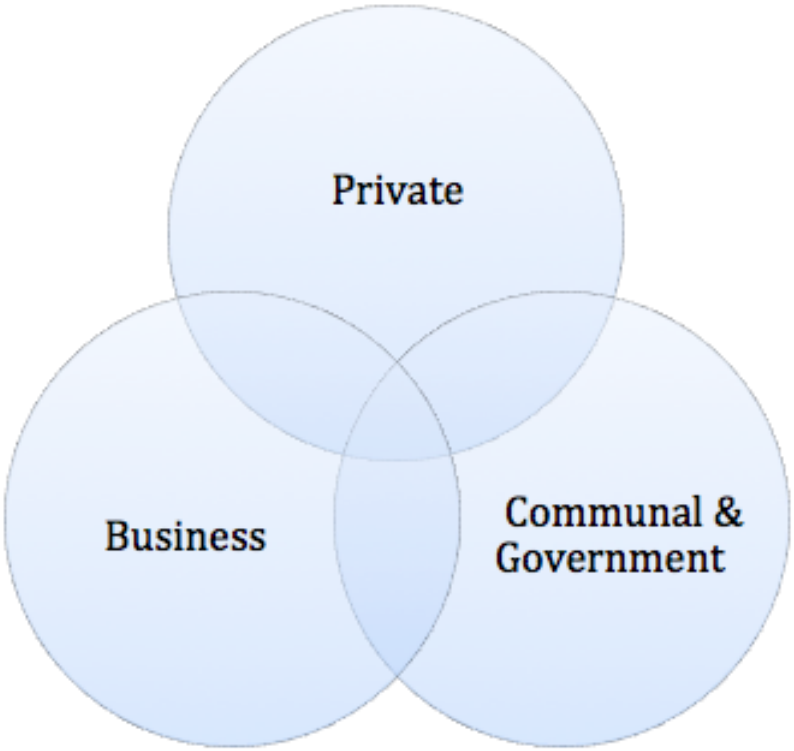


Figure 2.8: Markets in our everyday society that benefit from the utilization of high-speed broadband [Stople, 2011].

more than one area. As already mentioned in the Introduction (Section 1.5), this paper will focus mainly on the Business market, as the research work that has been performed in this project has been concentrated on businesses (in the hotel- and accommodations sector). Nevertheless, benefits from all three markets will be reviewed in the following subsections:

2.3.1 The Private Market

Individuals and households represent about 85% of the broadband market, while companies represent only the remaining 15% [Com08]. Using the Internet for personal purposes, it is clear that these individuals are without doubt able to understand the importance of using broadband to do jobs faster and to share information with their environment. The high-speed broadband infrastructure and the use of the Internet improves the broadband readiness in the local society, and can be said to have a direct influence on residential environments.

2.3.1.1 Home Entertainment

High-speed Internet networks (e.g. FTTH, HFC & VDSL) have brought better Internet- and TV-offers to people living in both rural and urban areas. This might be especially important for the younger generation, who regard digital- communication and entertainment as a vital part of everyday life. When speaking about innovation on the Internet, and the impact of broadband both socially and economically, much emphasis must be put on the growth of the market for online entertainment. For instance, as some video features are possible under basic or fast broadband, high-definition (HD) video, multiple concurrent instances of video and video on demand - accessing a library of titles - are more plausible with very fast broadband.

Lately, telecommunications and cable companies have started to offer the so-called triple play technology - bundling together voice, data and video - thereby combining advanced technology and convenience for the end-user. Using underlying fibre or DSL, these features have the potential to offer benefits over existing applications. IPTV (Internet Protocol TV) is a substitute for ordinary television transmission, and can offer high-definition image quality if the broadband capacity is large enough. The emergence of 3D-TV is another feature of late that will require reliable high-speed broadband in the future. Video-on-demand has started to fulfill its potential in replacing other forms of video rental, and brings with it advantages of flexibility, availability and the cost of provision. The advances of IP-telephony and videoconferencing increases the attractiveness to use these options for communicating and interacting with others, resulting in savings in both travel time and usage costs.

In the last couple of years the use of social networking has practically exploded, with the sharing of content online rapidly increasing. Being able to share both pictures and video online, for instance on YouTube, Twitter, Picasa and Facebook, has the potential to benefit greatly from increased broadband speeds. Faster upload speeds permits faster sharing of higher definition photos and videos, leading to more uploads and downloads, and a more popular service.

2.3.1.2 E-Learning

Since the development of broadband Internet, multimedia possibilities and interactivity has lead to the possibility of using the Internet for education purposes, or "e-learning". As the Internet is an efficient way to spread knowledge, public and private education providers are continuously developing courses they can offer on the web. Although e-learning can't replace live education to the full, as a motivating learning environment should be an integral factor in any education, online courses will reduce the amount of time and money that gets spent while traveling.

For learning purposes in general, the Internet is largely used as a tool

to acquire autonomy in the knowledge society. Students for instance, very seldom receive knowledge or information on the Internet provided "ready to learn" by a professor or a teacher (as they would do in a classroom or lecture hall). Instead they use the Internet to search for the necessary information or solutions, thereby being part of an active learning process. The contribution of the Internet in research-activity in general will certainly continue to have an impact in the future. It will be an important tool in education, both private and public, as well as in flexible, professional environments - as workers today continuously have to solve new problems and find new solutions. Having the Internet available at all times, either at a computer, or on a mobile unit, has therefore turned out to become a necessity in our society today.

2.3.1.3 Other Benefits for the Individual

A great benefit broadband can bring to private individuals, is the aspect of Tele-working. Since this can bring gains to both the worker and the employer, although introduced here, it will be further discussed in Section 2.3.3, "The Business Market". Faster broadband has the potential to increase teleworking and the benefits that follow from it. Working from a home office, or while on the move, leads to a reduced need of traveling back and forth to an ordinary workplace. Hence, both use of time and travel expenses are reduced. Improvements to the capacity, to use videoconferencing in the home and to transfer files back and forth between the home office and the workplace, are key areas where higher and more reliable broadband capacities supports telecommuting. In addition, environmental gains for the society are increased because lesser traveling will lead to reduced pollution, as well as less traffic congestion.

Most of the possible services and advantages mentioned above can be achievable in the short term, making them very attractive for the individual user if the technology is accessible. In a longer timeframe, high-speed broadband has the potential to contribute to applications in home security, utility monitoring and control and home automation. The opportunities are nearly endless, and with the current evolvement of broadband technologies, both wired and wireless, Internet based applications services will continue to create a society where daily operations and tasks become hugely dependent on the availability, stability and quality of high-speed Internet.

2.3.2 The Communal- and Government Market

Moving from the private market over to the communal- and government market, one can identify benefits that are shared by both markets - thereby justifying the "overlap" that is seen in Figure 2.8. The fields of teleworking and e-Learning are clearly benefits for the communal market as well, as this market represents schools, hospitals and other government institutions. The use of high-speed internet in rural areas can without doubt increase the educational

opportunities for students, by offering lectures that are held at other schools and universities online by the use of videoconferencing. Also, while on the move, students that have access to a good broadband connection can log on to their school network at a remote location and follow classes, read important information and submit schoolwork online. This kind of tele-working might be especially beneficial for students that are situated in less central areas, or that are heavily involved in school-related organizations that might be doing quite a bit of traveling - like those involved in sports-programs.

Continuing to e-Learning, the evolvement of high-speed Internet has lead to an increase in the use of digital learning platforms, like Fronter and It's-Learning. Because of fibre and other high-speed technology penetration, a larger amount of student-work can be performed and documented through these platforms. By offering information and school-related materials online, in form of digital solutions, expenses on books and paper can be reduced as a direct result. High-speed connections also will also make it possible to use the Internet better as a learning resource, since the high capacity broadband is able to carry data loads that might be necessary when using both sound- and video-clips in online learning programs.

Broadband networks are adopted by local agencies (or even entire communities) to support the provision of government services, and to encourage local innovation and knowledge access. An end user may not be aware of the presence of a broadband network in the community, as it is the government that is the broadband user in this situation. Most public organizations at the national level are aware of the potentials of efficiency improvements follow from broadband technologies. The development of e-government shows that public services increasingly make efforts to provide online services to citizens and businesses. E-government and a couple more beneficial areas of use are described in the following subsections:

2.3.2.1 E-Government

Just as technology has been an important determinant of productivity in the broader economy, so has the application of information technology and quality of public services. E-government (electronic government) is a general term for describing the use of technologies to facilitate government operations and the disbursement of government information and services. These technologies can serve a variety of different objectives: to empower citizens through information access, to better deliver government services to citizens, to improve interactions with business and industry or merely to manage the government better. In an attempt to define the term e-Government, we can look at the World Bank's formulation [3]:

> *"E-Government refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government."*

Traditionally, the interaction between a citizen or business and a government agency would take place in a government office. With the constant upgrade and spreading of information and communication technologies it is now possible to move these government centers closer to the citizens, for instance by using unattended computers at the government office, or utilizing a personal computer at home or at the office.

As the government already provides its citizens with certain e-government services, the establishment of high-speed broadband may see the government improve and broaden the range of online services. The underlying importance should in any case be that anyone should be able to visit a city website and communicate with city employees via the Internet - by either using graphical interphases, instant-messaging, view audio- and video content or accessing and transmitting administrative forms.

The government's use of e-services has a direct impact on citizens, businesses as well as itself: it reduces the administrative burden, as public employees uses broadband technologies to work more efficiently. Less time is spent by physically traveling back and forth to the government agencies, information and forms can be easily accessed, and processing time is highly reduced as a result of the elimination of messengers and postal services as message carriers. In the administration, time and effort is saved by storing files and linked information in databases versus having hardcopies stored in different locations. The latter proposes a pretty obvious benefit in cost savings, as the use of the Internet leads to a significant decrease in paper consumption.

One area of e-government that is currently finding its way to the digital world, is the electronic voting (e-vote). In the fall of 2011, the Norwegian Ministry of Local Government and Regional Development will be carrying out the "E-Vote 2011-Project", where the objective is to implement trials with electronic voting at municipal elections in ten selected municipalities [22]. This means that citizens will have the opportunity to vote from home by using the Internet, as well as having the traditional choice of showing up at the polling station and vote using an ordinary paper ballot.

It is a challenging matter to ensure that the 3.5 million citizens that are entitled to vote in Norway are able to exercise their right, so the access to vote has to be organized in many different ways. Being able to do this electronically is one of them, and to be able to do so requires a well deployed broadband network that reaches out to all citizens. This would see to an improved availability for many groups of voters, like the functionally disabled or Norwegian citizens situated abroad. Younger generations also have certain expectations to the use of e-services. By introducing the electronic voting system, young

people, who traditionally display minimal interest in government affairs, may be drawn to e-voting procedures.

Worth mentioning is also the fact that an e-vote service would result in a quicker and more accurate counting procedure, as well as leading to reduced costs in the long run.

2.3.2.2 E-Health

The introduction of high-capacity broadband in the health sector has brought to life the exiting aspect of so-called e-Health. Health service provision involves many information-intensive contacts between a large number of players, e.g. hospitals, pharmacists, health insurers and patients. Broadband technologies bring with them the possibility to exchange large quantities of multimedia information about symptoms, treatments, patient history or administrative information - both securely and in real time. Also, checkups and diagnosing, based on virtual data or data from instruments, could be done without the patient and health-personnel being at the same physical location.

Large hospitals may be currently well served by broadband, but small hospitals and medical centers, individual doctors and private houses are very likely to benefit from improved download- and upload speeds and reliability. This is especially the case in remote areas, where such "telemedicine" can lead to a reduced need of transport of patients to and from the hospital, thereby leading to considerable savings in respect to both time and expenses. Remote areas will also benefit from the fact that health professionals can receive training and support online.

2.3.3 The Business Market

This subsection will describe some of the areas in the business market that can benefit from the use of online services, provided if given access to a high-speed broadband network. The reason for emphasizing the benefits in this market is that they will be mentioned later on in this paper - first when the feedback to the hotels are laid out in Chapter 6, as well as when scores based on broadband utilization are presented in Chapter 7.

When a business chooses to introduce ICT, many changes are undergone. These changes may explicitly involve employees, but will in any event affect their way of working, the skill they use, their professional identity and the relations between different functions and profiles inside their enterprise. The use of broadband technologies is promoted to provide improved or innovative services. It is safe to say that technological change in the work-domain has been dramatic and very widespread during the last two decades, and it has gained great importance in information- and knowledge-intensive areas of work.

"E-business" is a term for making use of internet-based business tools, including e-commerce, company websites and other online services. Basic use of

e-business services can be done by any company without advanced IT-skills, and doesn't require more than a narrowband[6] connection. Such services may include the use of e-banking and e-government, searching for information about providers, to search for new products on online marketplaces and to exchange e-mails with customers and providers. Introducing broadband, however, is essential for the integration of intensive e-business technologies into a company's daily processes.

Customer relations is an important part of the daily activity for companies in the service sector (which includes the Hotel- and accommodations-sector which is the subject for this paper), as it represents on average 50 percent of a service company's activity (including sales) [Com08]. Managing to improve the efficiency by using broadband technologies for customer relationships is therefore essential for the competitiveness of businesses in this sector.

Teleworking was mentioned for the private market, but there are many potential benefits for the employers as well. The introduction of teleworking could lead to reduced costs for businesses in terms or real estate and office requirements. Many simple tasks, like checking and answering e-mail, can also be done on the move, when commuting for instance, by using handheld devices. This would save time when arriving at the workplace later on. Also, setting up a home office for the employee may decrease retention costs for employers, as employees are more likely to stay on board if they are offered a wider range of flexible work options.

The creation of new enterprises as a result of broadband introduction, is especially visible in rural areas, i.e. areas that earlier may have suffered from little or no Internet connection at all. As high-speed broadband has the ability to carry large loads of data over long distances, ICT enterprises are able to situate themselves in these areas. Services like server-hotels, databases and general data storage for customers are made possible despite these long distances. In other words, small enterprises can arise anywhere, as long as there is a well-developed high-speed network in place.

Just as important as the arising of new workplaces, is the preservation of the already existing ones. Companies that were situated in an area before the networks were upgraded to high-speed Internet, may feel it essential for the companies' development and continued operation to invest in the new technology. Both time and money can be saved as a result of less work-related traveling, as more of the interaction with customers, suppliers and collaborating partners can be done electronically, like the use of videoconferencing. Reduced telephone-expenses can also easily be accomplished by using new solutions like IP-telephony, hereby replacing traditional, more expensive telephone services.

[6]Narrowband refers to a signal which occupies only a small amount of space on the radio spectrum, delivering speeds up to 56 kb/s.

2.3.3.1 VoIP

Voice over Internet Protocol (VoIP) telephony is a way for both private individuals and businesses to utilize the Internet, instead of using the Public Switched Telephone Network (PSTN) or cellular networks to perform phone-calls. Being a low-cost, or even free, alternative to these mentioned means of communication, VoIP can cut business expenses as well as making a company more available for its customers.

Often sharing the same broadband line as ordinary Internet traffic, VoIP telephony can reduce telephone expenses for businesses. Broadband service providers often offer fixed-price deals, where the user may enjoy unlimited use of VoIP telephony (often in bundles with regular Internet use). However, an important criteria for this to be attractive is the existence of a high-speed broadband connection, as low-speed connections are more prone to congestion and packet loss - resulting in poor telephone-conversation quality.

Using the Internet application Skype can reduce costs for a business, as well as making it more available for contact to customers. As mentioned in Section 2.2.2.1, is Skype a free application that can be installed on any computer - or even on handheld mobile devices. Using this application to make calls within the company, or to employees that are either working at home or are on a business trip, can reduce the expenses on phone-bills. Skype also has the option of debiting money onto an account, and use this to make calls from the computer (or handheld device connected to the Internet) to a landline- or cellular phone.

By making a Skype company-account, and making the contact information available on e.g. the company website, will introduce a new way for people to make contact. This is a great way to cross international borders in todays business world, as people may refrain from making telephone contact if they have to pay international charges. VoIP is a great way to overcome such a barrier.

2.3.3.2 Cloud Computing

Cloud computing has potentially high benefits. For instance, users can access all of their documents and data from anywhere, as long as they are in possession of a device with Internet access, like a home- or work computer or other mobile Internet enabled devices. Although this access method has become quite usual for accessing applications - such as email and social networking cites (Facebook, Twitter etc.), it is likely that the capacity provided by high-speed broadband networks is needed if one wishes to access all one's documents and data.

One of the characteristics of cloud computing is that it is hugely flexible - meaning that if a business needs to expand its resources, this can be done easily without having to buy any extra infrastructure. As well as being possible to implement in minutes, the businesses can easily decide when to "degrade"

their resources again if they don't need the computing power anymore. This is a great benefit for small- and home-based businesses, who may use these "pay-as-you-go" models when they are needed. They will unnecessary costs, which again gives them an advantage when trying to establish themselves and compete in the market.

Many people have doubts of the security aspect of cloud computing, and they are rightfully so. Trusting company sensitive company information and secrets in an infrastructure somewhere else than within its own premises, is difficult - as extensive values can be at stake. However, clouds tend to be more secure than the traditional business models, and are actually less prone to hacks and DDoS[7] attacks, as people don't know the whereabouts of the stored data. Also, if a cloud should be hit by an outage, users can use their private backup servers, that will automatically synchronize with the main ones as soon as they are running again.

In the market today there are many cloud computing services that people can utilize given the needs. Amazon Web Services (AWS) is the pioneer in the cloud computing market, and is currently the market leader [26]. Among many services offered, it allows companies to perform operations for displaying complex graphics at high speed. Other, maybe more known services are DropBox and MobileMe, which are cloud sites where one can upload, access and share files and personal data from any location.

Cloud computing is also environmentally friendly. By using the pre-made resources only when needed, one can reduce electricity expenses. While saving on electricity, businesses can also save on resources required to cool off computers, servers and other components. This again reduces emissions that are dangerous to the environment.

2.3.3.3 Mobility

The aspect of mobility has already been mentioned, both when discussing teleworking in the beginning of this section, and when discussing cloud computing above. Cloud computing gives employees access to data - both public and private - from any corner of the world - even on mobile devices.

By using mobile devices, tens of millions of workers who are mobile on their jobs, for instance airline pilots, mail carriers, farmers, fishermen, repairmen and sales clerks, can do their jobs in much more efficient ways, as they now can be empowered with the kind of powerful technologies that previously only office workers had [IBE11].

According to a business report calculated by Telenor in 2009, a third of all work-related phone calls are done at other locations than the workplace [Tel09]. This shows that workers today are getting less dependent of having

[7]A DDoS (denial-of-service)" attack is an attempt by attackers to prevent legitimate users of a service from using a service, either by crashing or flooding the service

the office as the workplace - as work can be performed at home, in the car or in the offices of a customer. Also, by performing some work tasks on the run clears up time do to other tasks - meaning that workers are more efficient during the course of a work-day. This report claims that, in Norway, 1 out of 4 (27%) workers perform parts of their workday outside their normal workplace, underlying how mobile our workday is starting to become.

2.3.3.4 Social Media Network Marketing

Social media marketing is the process of using social media sites to promote and market businesses online. By utilizing the social aspect of the Internet, social media marketing has the ability to connect and interact on a much more personal and dynamic level than what is possible with traditional marketing.

Just as social networking websites allow individuals to interact with one another, it lets businesses build relationships with potential customers. Using social networking sites, such as Facebook, Twitter and Youtube, lets businesses reach out to a whole new audience than what they previously might have done. A business can promote products and available deals on these sites, which can be viewed by many potential customers. In fact, most of these interactions are at a more personal level than ordinary commercials, as the individuals that receive the advertisements must have registered with the business in some way at a previous point in time.

Social media can take have different shapes, including text, images, audio, and video. This section will briefly describe some of the benefits that can be achieved by using the following, well-known social networking sites: Facebook, LinkedIn, Twitter and YouTube.

Facebook really can be considered the king of social media. As of January 2011, Facebook had more than 600 million users [10], making it a potential market businesses really should identify as a potential area of marketing exposure. What is special with sites like Facebook and Twitter, is that customers will have to register with a company's page in order to receive information - on Facebook by "liking" the company page. Also, social networking sites act as a word of mouth - with the users promoting the company's business by spreading the information on the website, by "reposting" the company's messages or sharing links with their friends. By doing this, more people will hear of the company, and information about products and deals will be spread and get repeated - potentially adding more traffic to the company's webpage.

Like Facebook, Twitter is a free networking site that is used to spread company messages, offers and product out to potential customers online. On Twitter this is done by "tweeting" personal messages that can be read by people that have selected to follow that companies messages - or so-called "tweets". By having individual followers re-tweet the business' message, it will get viewed by everyone that has registered to those followers, and so on. Spreading the word like this works very much in the same was as on

Facebook, with an expanding network of friends and followers being able to see the companies' original advertisements.

LinkedIn is a business oriented social network for professionals on the Internet, with more than 100 million members in over 200 countries and territories [19]. A powerful feature that LinkedIn can offer, is the "recommendations" that can be added to a company's profile. By encouraging customers, clients or vendors to write a note on the company's or organization's profile, helps them look more credible for potential customers. LinkedIn is also a great way to look for and get in touch with future employers and employees.

By linking to a YouTube video clip on a business website, gives a company or organization a great way to advertise for its services or products for free. Because of its social structure, YouTube is a great way to interact with customers. Users are able to spread the video among themselves, and they can leave comments on the video for future viewers to see. By adding an embedded video on the company website can very easily make a customer choose that company's product in preference to a competitor's. Accommodation businesses can, for instance, add a video showing the customer the premises of the hotel, the activities that can be enjoyed, as well as showing off the surroundings - either this is a video-clip from a buzzing city or from an enchanting natural environment.

Social media marketing can be a phenomenal marketing channel for both small and large businesses and organizations. In a market where everything is about beating the competitors to the customers, it's vital to grasp all possible opportunities that may arise. Utilizing broadband Internet for online advertising is certainly one of them, and will most likely only become more important as more and more people obtain access to the Internet, get accustomed to its use and learn about the possibilities it can bring.

2.4 Strategic Networks Group

This section introduces the Canadian broadband specialist company, Strategic Networks Group. As a contributor in this project, they have offered their knowledge, tools and expertise. In order to best understand the possibilities that alay in the world of broadband technology, they have developed many methods and calculations. An introduction to their Broadband Lifecycle and Digital Economy index will be given, as these have been experienced hands-on during the course of this project.

2.4.1 About SNG

Strategic Networks Group was formed in 1998, and brought together industry specialists carrying large experience in how to help communities evaluate their technology investment options. Their headquarters are located in Ottawa,

Canada, and they also have company offices in Australia, in France and in the United States.

Today, SNG's team consists of 15 specialists, who hold decades of accumulated experience providing support in the areas of strategic planning, business- and economic analysis, network architecture as well as project implementation. These skills put together, SNG works toward enabling the most broad-reaching and transformational impacts that broadband can bring to businesses, communities and regions.

Since their establishment, SNG have worked towards their goals of encouraging economic development, social advancement, increased productivity and competitiveness in the broadband market. For years they have been helping governments, at municipal, regional and national levels to understand where investments will have the biggest impacts. In this process, SNG have developed proprietary methodologies and survey tools enabling them to quickly collect the data needed to perform the research. Following this process, SNG can, by using their own specialists, provide roadmaps for businesses to achieve successful impacts both economically and socially by investing correctly in broadband applications, skills and services and exercising these correctly. This process is described in more detail in section 2.4.2.

2.4.2 SNG's Broadband Lifecycle

As an approach to best plan, build, encourage and track broadband networks, SNG has developed the "Broadband Lifecycle". This cycle can be understood as a journey of broadband investment, where SNG, as a broadband expert, has the competence to help businesses, organizations and individual households understand how to adapt to the ever-evolving world of broadband. The Broadband Lifecycle can be seen in Figure 2.9 and has the following steps: (1) Identify needs, gaps and demands, (2) planning and capacity building, (3) decision to invest, (4) build/expand network capacity , (5) promote awareness and adaption, and (6) assess outcomes and impacts.

All of these steps assembled together make up a "cycle", where the goal is to provide the customer with the adequate information so that they can ready for investment in broadband - and thereby harvest both economic and social benefits. The following subsections will give a short insight of the different steps in the Broadband Lifecycle - as several of these have been performed by the author during the course of this masters' thesis.

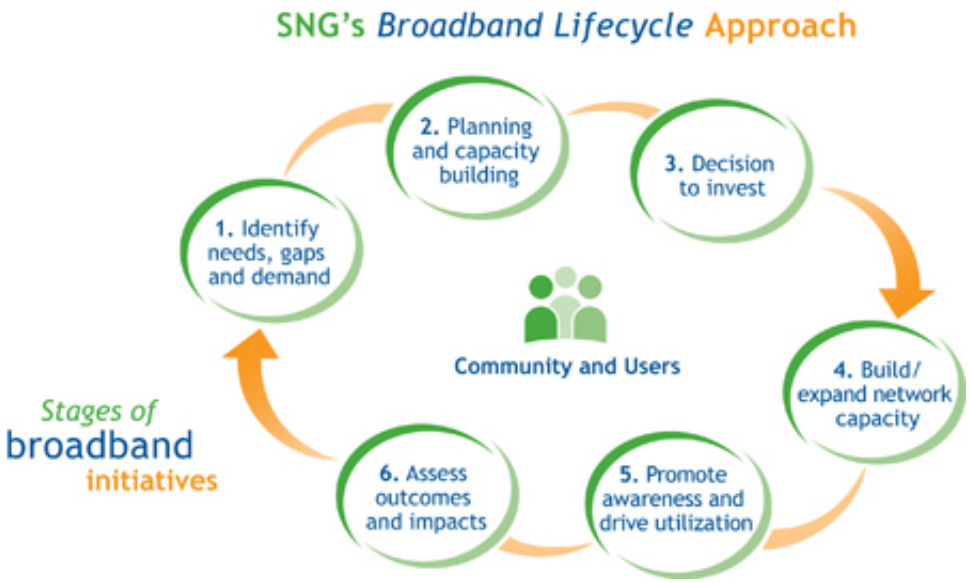


Figure 2.9: SNG's Broadband Lifecycle. [16].

2.4.2.1 Identifying Needs, Gaps and Demands

This is the first stage of the cycle, and definitely one of the most important ones. In order to collect potential economic and social benefits, one has to identify the opportunities for increasing e-solutions utilization.

By using customized online solutions, SNG can collect information about e-solutions usage directly from businesses, institutions and organizations. By sorting this information by defined geographical areas and industry sectors, results can be stored for future references and comparative analysis of the broadband market.

As this data is collected, SNG gets an overview of the e-solutions utilization of the surveyed part. They also find out what their drivers or barriers for the use of e-solutions are. Among the results, SNG can calculate a Digital Economy Index (DEi) score which easily provides these companies or organizations an assessment of how they compare to their peers and where they should consider future investments in broadband adoption. An example DEi-scorecard can be seen in Appendix C. More about the DEi-scorecard will be presented in Section 7.1 when introducing the calculations of broadband utilization scores.

The importance in this step can easily be summarized. Every community, organization and individual has different needs in terms of broadband. Therefore, it is important that the mapping is done thoroughly before any investments or decisions are made, as gaps and needs can differ quite considerably from one region or sector to another. If not done properly, these gaps can get overlooked and profits may fail to come, or not appear to their full extent. In certain situations, investments may not even be necessary at all.

2.4.2.2 Planning and Capacity Building

After performing the first step, the collected results have to be taken through a phase with extensive planning before further actions are taken. The community in question may not even be ready for a "launch" of broadband technology. Strengths and weaknesses in the community need to be analyzed, and certain gaps may need to be assessed in order to achieve a successful implementation of broadband.

Over the years, SNG has guided numerous communities through the exploration of the potential and possibilities a broadband network provides. Each community has both different needs and strengths, and racing to copy what another community has done, in the search for economic and social benefits, is very seldom the best way to go forward in the field of broadband innovation. Rather, this step pushes the importance of surveying informed stakeholders that are involved in the preparation effort - covering several areas that judges how "ready" the community or enterprise is for a broadband investment.

2.4.2.3 Decision to Invest

This stage can often be the toughest stage in the cycle. At this point, it is evident that the customer is aware of the benefits that broadband can bring to its community. This phase is about helping the customer, with its shareholders and decision-makers, by offering assessment tools that creates the required market intelligence and comprehensive understanding of the relative value of key factors. Deciding to invest in broadband technology will always be a major decision to make, as it's difficult to calculate the effects of such an investment in advance.

By the end of this phase, the customer will have an understanding of the investments that are required, where they will come from, what the measurable benefits will be, and most importantly - if these benefits outweigh the investment costs. It is all about being "ready" for the upcoming broadband investment.

2.4.2.4 Build/Expand Network Capacity

As the title says, this stage is about implementing the broadband network. However, this is seldom as straight-forward as many might think, and there are many implications that easily can get neglected. A broadband plan needs to be set up, making sure that the network fits the community's current and future needs. The providers' requirements need to be determined, and the most cost-effective solution for the business needs to be identified. The bottom line of this stage is to make sure the customer implements the broadband strategy that best optimizes the desired economic benefits and also achieves financial sustainability.

2.4.2.5 Promote Awareness and Adaption

Once the broadband network is in place, the consumer is ready to reap the benefits. Nevertheless, not even the best network product or service in the world has a chance of succeeding without the users learning about its availability and features. If an e-service is difficult or confusing to understand, more times than not a consumer will continue in the same ways that they are currently doing - ignoring the potential benefits. Some consumers may not even know about the services that can be utilized with this new network. The purpose of this step is to overcome this inexperience.

In order to help the customer drive the utilization and the effectiveness of a customers broadband network, SNG performs an "outreach program" to engage households and businesses and explain to them the vision of their broadband initiative.

When performing this outreach, SNG performs a so-called e-Solutions Benchmarking on the stakeholder or community, and derives the necessary intelligence from this. This benchmarking is performed by issuing an online survey, and performing a thorough analysis of the submitted results. This collection of usage data is critical for an effective broadband planning, because the results will help the customer understand how their broadband is being used - as well as learn what e-services would be cost effective not only today, but also several years down the road.

Either it is helping the consumer identifying effective adoption strategies and plans, to ensure that they receive the training that is fundamental to master the available e-services, or to provide them with the necessary information that is needed, the overlying goal is to reinforce the network sustainability and increase the economic impact of the broadband investment.

2.4.2.6 Assess Outcomes and Impacts

Sustainability is essential to provide an ongoing success, and this step is constructed to ensure this. Here, a validation of the broadband investment decisions is performed, analyzing if there are both direct and positive impacts of the investment.

It is important to measure the utilization and to identify gaps in order to adopt properly. Also, if the results show potential and the economic development is positive, further investment in network expansion and upgrades should be considered in order to achieve even greater social and economic awards.

2.4.2.7 Back to the Start

To sum up the Broadband Lifecycle, one can add a final step to this broadband adoption process: Going back to the beginning and doing the whole cycle

all over again. Once the business is adjusted to the current strategies, new strategies need to be planned out as the market and technology evolves.

The purpose of the Broadband Lifecycle is to create a platform for productivity, competitiveness and innovation not only for the business, but for the whole region as well. Rather than being part of a network that may not be used, it is certainly the interest of all parties to bring the whole society up to a level where they can together prosper from the benefits that broadband is certain to give.

2.4.3 SNG's Digital Economic index

SNG's Digital Economic index (DEi) is a composite indicator of how organizations use Internet-enabled applications. The DEi score is normalized on a scale from 0 to 10, with 10 representing the maximum utilization of a range of Internet applications, also called e-solutions, relevant to the most organizations' operations.

In order to quickly analyze the e-Solutions Benchmarking, which is the benchmarking survey that was performed in this project, SNG has developed an online tool called the DEi Monitor. By using data collected from individual businesses and organizations, the DEi Monitor provides a score that can be used for comparative assessment of e-solutions usage by organizations on a regional basis. This data includes industry-specific information so as to identify potential gaps and opportunities in utilization, and the possibility to increase the use of e-solutions to achieve economic and social benefits. Recalling SNG's Broadband Lifecycle, the DEi score is often used as an important part in its three first steps: (1) Identify needs, gaps and demands, (2) planning and capacity building and (3) decision to invest.

Figure 2.10 shows an example DEi-score generated by the DEi-monitor:

2.4.3.1 Value of the DEi

As seen in Figure 2.10, the DEi can quickly show if an organization's Internet utilization is above or below the median DEi for its industry, thereby indicating where they stand in relation to their peers. In addition, the DEi value indicates on a scale from 0 to 10 an organization's current level of utilization of Internet-enabled applications. In the figure, for instance, a DEi of 5.4 indicates that there is opportunity for additional use on the Internet within a business' operations. Reacting to these opportunities would result in a higher DEi, as well as the potential of bringing economic benefits.

2.4.3.2 Derivation of the DEi

The DEi is calculated from research of actual uses of Internet-enabled applications by the surveyed business or organization across 17 utilization categories.

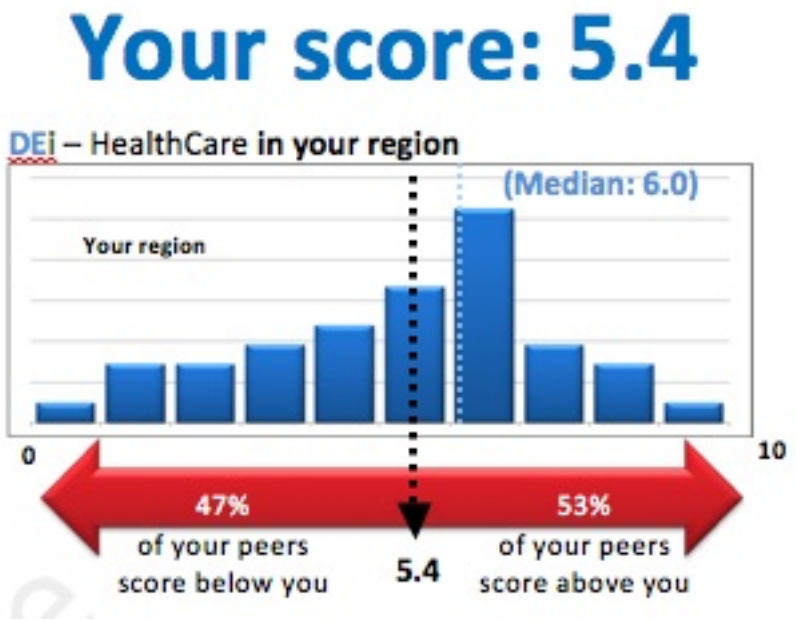


Figure 2.10: Example of a DEi-score calculated by SNG [14].

Each category is differently weighted based on factors of complexity in terms of technical implementation and internal process impacts. In other words, more complex uses of the Internet, such as online customer service, are given greater emphasis in the DEi score than activities such as buying goods and services online.

Most organizations can relate to two relevant basic groupings of e-solutions utilizations:

- *e-Commerce utilizations*, like advertising and selling online, offering online customer service, utilizing websites, etc.
- *e-Process utilizations*, like staff training, teleworking, online collaboration and supplier communication, etc.

Put together, these Internet-enabled utilization categories (as well as a couple more) make up a composite that results in a DEi-score. Appendix C contains a demonstration DEi-scorecard provided by SNG, and shows several feedback points that often accompanies the DEi-response to a business or organization.

Chapter 3

Research Procedure

3.1 Outline

This chapter describes the practical work that has been carried out in this project. First, a short recap is given on the choosing of geographical sectors, as well the reasons for selecting the specific industry sector. Section 3.3 describes how the information was retrieved form the selected enterprises. This includes both how an online questionnaire was put to use, as well describing the method of communication that was engaged between the researcher and the businesses.

While phases 1 to 4 presents the *retrieval* of information from the hotels in a benchmarking survey-process, phase 5 describes a follow-up process, where a *feedback* is given to hotels, based on results from the benchmarking process.

Section 3.5 describes this follow-up process. It was performed by the researcher in this project in co-operation with the Canadian company SNG (presented in Section 2.4). Several steps were undergone in this phase, including the calculation of a DEi-score, the construction of an invitation, as well as communicating the feedback with the hotel.

An overview of the phases in this research procedure can be seen in table 3.1. Phase 1-3 and 5 are described in this chapter, while phase 4 is thoroughly explained and investigated in Chapter 4.

Table 3.1: Phases carried out in the research procedure.

Phase 1:	Localize geographical area and choose industry/sector for survey. Identify enterprises of interest.
Phase 2:	Construct online questionnaire for information collection.
Phase 3:	Contact enterprises by email & telephone for participation.
Phase 4:	Retrieve results from database and perform analysis.
Phase 5:	Perform a follow-up process. Provide feedback to selected hotels based on previous benchmarking.

3.2 Localizing Sector & Geographical Area

The selection of a sector for this research project was a fairly easy choice. After completing a similar benchmark study in a project in the Fall of 2010, resulting in very good response rates, the choice fell on the same sector - the hotel- and accommodations sector.

An important aspect for choosing this sector was that this its enterprises are fairly easy to get in contact with, as they have customer services that continuously handle both incoming e-mails and phone calls. Also, this sector is a perfect match for the basis of this benchmarking - broadband utilization - as hotels have a huge potential for broadband usage in their daily operations. The hotel- and accommodations sector are unique in the way that their size, owners and locations influence their customer basis and daily operations differently. Carrying a huge potential for opportunities, brought by high-speed broadband, made them very interesting subjects for this research.

Supporting this project was the broadband specialist company SNG, and the choice of sector would necessarily have to interest them as well. After experiencing a very good response-rate in the Fall project, SNG were very interested in maintaining focus on the same sector as well. Having built up a solid database of research information, collected from broadband readiness and usage studies in the US, the hotel- and accommodations sector fitted their bill. Their coverage is in fact quite astonishing: as of December 2010, SNG was regrouping data on 14.000 organizations, households and businesses - indicating that they currently own the world's largest database on broadband utilization. The tourism industry, which holds the hotel- and accommodations sector, is one of the areas where they have developed a profound foundation for performing comparative analysis's.

After choosing the industry, the choice had to be made on the geographical location as where to perform this study. Norway advertises itself as a country of great nature, and the tourism industry lays this as its basis when attempting to allure tourists - both national and foreign. When selecting the area of study in the project in 2010, attention was put on the attractiveness and fascination of fjords, and the hotels surrounding them. As can be seen in [Sto10], the choice then fell on the Hardangerfjord in Western Norway.

For this project however, the choice fell on an area far up north in Norway - namely the Lofoten and Tromsø area. When selecting an area where it could be interesting to perform this survey, it had to be put in thought what tourists come to Norway to experience. Lofoten is surely one of the most popular regions to visit in Norway, as it exhibits a famous, genuine coastal environment. Bjørnstjerne Bjørnson, one of Norway's most famous writers, once said: "One has not seen true nature until one has been to North Norway, and most beautiful of all is Lofoten." As the mainstay for one of the most important industries in the history of Norway, namely fishery, Lofoten has

therefore worked on developing a sense for tourism as well. The Lofoten region consists of an archipelago that stretches 200 km into the Norwegian sea, and has a total of 25.000 inhabitants. Albeit the small population, the area still has a large number of visiting tourists every year. Mainly consisting of charming fisherman's shacks, the region can also offer bed & breakfast's and a few hotels. Because of the ruralness of this region, investigating how enterprises here utilize broadband and its services would be very interesting, as this area appears to have great potential.

Figure 3.1: The beach at Haukland in the municipality Vestvågøy in Lofoten, Norway [20].

Tromsø stood out as a natural supplement to the Lofoten area, representing a more urban region in Northern Norway. With a population of 65.000, Tromsø is actually the largest city in the Nordic countries north of the Arctic Circle, and is home to the world's northernmost university, brewery and cathedral. Also having one of Norway's most scenic landscapes, Tromsø attracts tourist because of the surrounding weather-beaten islands of the Arctic Ocean, the blue fjords, and the nearby, towering peaks of the 1.800 meters high Lyngen Alps.

In addition to performing the research study in the Lofoten and Tromsø area, a number of hotels were also picked out in Oslo - the capital of Norway. Oslo is the largest city in Norway, with a little over 600.000 inhabitants. This area was added to the research both because of its size, and therefore many potential feedbacks from hotels, but also because it provides the possibility to add diversity to this research. Oslo is a center for tourism in Norway, with a great number of hotels and accommodations, and to see how they currently utilize broadband services was very appealing.

Table 3.2 shows an overview of the municipalities that were finally chosen for participation in this broadband analysis project. Along with the name of the municipal is the number of surveyed hotels and accommodations they each

contain.

Table 3.2: Municipals chosen for the e-Solutions Benchmarking survey.

Municipal	***Number of enterprises***
Flakstad	3
Moskenes	9
Oslo	58
Røst	4
Tromsø	22
Vestvågøy	7
Værøy	4
Vågan	24
Total	**131**

In total, a number of 131 accommodation enterprises were picked out as potential participators: 51 from Lofoten, 22 from Tromsø and 58 from Oslo.

3.3 Collecting the Information

Before sending out the online questionnaire to the hotels and accommodations mentioned above, some work had to be done as part of the preparation. First, the goal of the research had to be laid out, formed and confirmed by both the author and SNG, as both parties had interests in what kind of information the enterprises were to be asked about. After this was done, the natural step was to get in contact with the hotels and accommodations. These two processes are described in the following subsections:

3.3.1 Constructing the Questionnaire

SNG offered their already established online questionnaire system, the e-Solutions Benchmarking, for use in this project. The use of this questionnaire is mentioned when presenting the Broadband Lifecycle in Section 2.4.2 in the Background chapter. Since SNG's full-size version of the questionnaire is quite substantial in size, adjustments were made to the survey by thoughtfully selecting the necessary questions, with the aim of reducing the total number that were to be posed. The most important reason for shortening the questionnaire as much as possible, was to make it more attractive for the enterprises to answer it. By doing this, one does give up on some potentially interesting information, but, as long surveys often act discouraging, more weight was put on trying to achieve a higher response rate.

As the online questionnaire that was used in this project is the property of Strategic Networks Group, it is not available for representation in this paper[1].

When putting together the questions for this questionnaire, most of the weight was laid on how the accommodations utilize their broadband connection, e.g. what kind of services they are using, wish to use or have no plan on introducing. It was also interesting to survey them on their Internet connection as of today, and their current satisfactory level of their connection. In the latter parts of the survey we decided to ask if they had experienced any social or economic gains from their use of the before-mentioned broadband services (if they had expanded, or maybe cut down on their staff, as a result of any late broadband investment).

The potential for statistical bias in a survey like this is a real possibility. It was therefore important to ensure that the questions were shaped correctly so that the respondents had minimal chance of misinterpreting the questions, or even misunderstanding the selection of answers that were presented to them. Heavy consideration was brought to the fact that the questions weren't going to be posed to people with english as their mother tongue, but instead (presumably) Norwegians with varying knowledge of the English language. Rephrasing and the addition of informative "boxes" were inserted where it was felt necessary.

All necessary adjustments to this survey were made utilizing IP-telephony conferencing with supervisor Thibaud Châtel in France, as well as with the SNG headquarters in Canada. The work that was put down here, resulted in the questionnaire that got deployed in this project.

3.3.1.1 Questionnaire design - Variants of questions

Despite not being able to quote any questions from the questionnaire that was produced, a look at the different formats of questions that were constructed in this survey can be done. This is important so as to understand what kind of choices the inquired accommodations had to place emphasis on when they provided their answers.

A number of different formats of questions were made possible:

1. *Open-ended question.*
   Some questions may have an empty text field where the respondent has to manually type in the answer. This is because the variation of answers makes it inconvenient to provide and pre-store the possible responses in the survey (like address fields and number answers). This type of question is deceptively simple in its form, but may be difficult for respondents to answer, as they may be unused to calculating values that

[1]For more information on SNG's e-Solutions Benchmarking, one can visit the website http://www.sngroup.com/sng-offerings/gap-need-demand-identified/

might get asked for, or simply be less willing to type in precise company information manually.

2. *Question with a menu of responses.*
   Many of the questions that are related to their current use of broadband technologies use this format. Here a possible set of responses is given in a range between "Currently use" to "No plan to use", with the respondents having to choose one. The main advantage with this type of question is that is relatively easy to answer, as they should be aware their current status. There are however a couple potential disadvantages with this: It may be subject to starting point bias, where the respondent may choose to go for the first offered alternative. A solution to this may be to randomize the order of the menu items, as this may partly offset this tendency. However, this does decrease the ease of answering the survey. Also, the respondent may choose to slightly deviate from their actual status when they see potential benefits they might not have thought about before. An example will be if they change their response from "No plan to use" to "Plan to Use", hereby offsetting the survey response.

3. *Iterative responses.*
   These are the same as above, with a certain amount of "bullets" representing the possible choices for the responder. Some of these questions are iterative, meaning that if the respondent answers "Currently use" on a question, the next screen will be a follow up on that question asking something about how strong these benefits of the broadband service has been, or how they have been received by the staff/customers. Answering "Don't currently use" or "No plan to use" would in this case skip the follow up question, as is it not relevant for the respondent. The format of the iterative follow-up questions might be a menu of responses, or just a field for the respondent to manually fill with their answer, depending on the question.

4. *Asked to perform a task.*
   When constructing this questionnaire, we decided to ask the accommodation about what their actual down- and upload speed was (in addition to their expected). To retrieve this information, we had to ask the respondent to follow a link that lead to a Norwegian website that offered a broadband speedometer. After running the Internet application on this external website, the respondent had to manually type in the number in a text field in the survey. Despite being a very interesting question to include in the questionnaire, the disadvantage is that the respondent might get demotivated when asked to do more than "straightforward clicking". With this in mind, we made sure to include an option to skip these kinds of questions and continue on with the survey if this was more desirable.

3.3.2 Making Contact

Before making first contact with the selected hotels and accommodations, an extensive effort was put into contacting governing bodies and organizations so as go gain some support for the survey - both by sending emails and performing numerous phone calls. Not much was asked from the governing bodies and organizations, as we only asked to use their name and logo in the survey, in exchange for the results and access to the final report. Travel agencies were contacted in all three research regions, unfortunately without any real success. These seemed to have little or no impact or saying on the accommodations they were representing, and were reluctant to jeopardize their connections by demanding anything from them.

The municipality of Tromsø were very interested, and contact with them were swift and successful. They thought this was a very interesting project, and were genuinely interested in the results from the survey.

The first step of attempting to make contact with the accommodations was by sending out an e-mail inquiry, explaining the project and the benefits that could follow from the utilization of broadband services. The survey itself was referred to by using a link in the e-mail. As a sign of gratitude, and as an attempt to increase the survey response rate, SNG offered to calculate to each and every hotel that answered the survey, a personal DEi-scorecard based on their answers [2]. To be able to have some time to process and analyze the survey responses, the deadline for the survey was set to the 27th of May.

An important step in the process of retrieving information was to follow up the initial email with phone calls to all the accommodations. SNG gave continuous updates on which hotels that had responded to the survey, so as to know which hotels needed to be followed up. By talking to the enterprises directly, after being forwarded from the respective hotels' receptions, the researcher had the chance to remind them of the deadline and to explain to the daily managers in person about the importance and potential of this project. If interested, the possibility was offered to them for the researcher to fill out the questionnaire for them, by reading the questions over the phone and filling in the answers manually.

3.4 Bringing in the Results

During the time this survey was active, a fair share of time was spent contacting the accommodations by phone in an attempt to bring in more survey responses. Personally providing an insight in the benefits of broadband services, as well as tempting them with feedback in the form of a DEi-scorecard, resulted in both more survey completions, and some rejections. Not wanting to participate very much underlines the cause of this project, as well as being a large part of

[2] SNG's DEi-scorecard was explained in Section 2.4.3.

SNG's business model - which is to make businesses aware of the possibilities and benefits that broadband can offer. SNG's Broadband Lifecycle emphasized the importance of this in the step called "Promote Awareness and Adaption" (Section 2.4.2.5).

Taking the time to call the accommodations was a very important step in this research procedure. As hotels and other accommodations receive a large amount of e-mails every day, there is a real possibility that the first inquiry to this survey gets read and then forgotten, or is received by a receptionist that forgets to forward it to the daily manager. Therefore, when sending out both the inquiry- and remainder e-mail, it was made sure that this was done during a time of day that makes the e-mail more likely to be handled correctly. In the morning, people often have many e-mails to read through, and therefore only answer the ones that are urgent. In the afternoon, people are more likely to be worn out and maybe longing to go home. At this time of day they are often be too tired to bother opening a survey, or they might postpone it as something to do the next day - which most likely leads to it being forgotten. Therefore, sending the e-mails out right before or after lunch-time was a priority, as this time of day is often the least work-intensive one. For the same reasons, the same time range was chosen when contacting the accommodations by telephone.

After hitting the deadline for survey submission and closing the online questionnaire for access, the received data was calculated and generated by SNG. The results were then submitted to the researcher along with similar data SNG had collected by performing similar benchmarking on a large number of accommodation-enterprises in the United States (in the states of Kentucky, Louisiana, North Carolina and Virginia). A total of 169 hotels and bed- and breakfast's were selected for study from these US states, and comparative studies were then performed between the Norwegian and the US market, with the former being based on the results of this survey. These results are shown in Chapter 4.

3.5 Follow-Up Process with the Hotels

The follow-up process was an integral part of this project. Based on the results of the online benchmarking survey, the goal was to identify gaps and needs in the hotel's broadband utilization, and to propose solutions to bridge these gaps. This section will describe all aspects of this process: Selecting which hotels to hand a feedback, identifying their gaps and needs, constructing invitations and actually communicating this information to the selected hotels.

3.5.1 Selecting the Hotels

As the follow-up to the hotels is a process that has to take place after the survey has taken place, and after the data has been calculated and analyzed, the accommodations were chosen from the preceding project that took place in the fall of 2010. Here, an almost similar benchmarking was carried out in the Hardangerfjord area in Western Norway - attaining a response rate of 22 %. Choosing hotels from this previous benchmarking, and utilizing information from the associated data set, would be an advantage in that the results were ready to be analyzed at the initiation of this project. No time had to be spent on waiting for the new benchmarking to complete in order to begin on the follow-up step, as the new benchmarking survey could be carried out simultaneously - thus utilizing time more efficiently.

When selecting hotels we tried to fulfill certain criteria. Of course, the accommodation would have to have room for improvement - or else there would be no interest in contacting them (other than to congratulate them on an excellent broadband service setup). Even though the evolution in the Norwegian broadband market is one of the best in Europe, as well as the rest of the world (as was exhibited in Section 2.1), there were still gaps in the broadband usage in all of the accommodations that was surveyed. Secondly, we wanted to deliver feedback to hotels that were in different stages of their broadband usage development. In other words: one hotel close to fulfilling its potential, and a second that was earlier in its development and naturally had larger room for improvement. The last criteria was that the hotel in the previous survey had answered "yes" when asked if they would like to be contacted by SNG in the future if we had any further questions.

The choice fell on two hotels from the Hardangerfjord area: Hotel Ullensvang and Hardanger Folkehøgskule/Hostel.

Both hotels are situated in the municipality of Lofthus. Hotel Ullensvang was founded in 1846, and started out as an accommodation with two beds - where one was for rent and the other was used by the founder. Over the years the hotel has been rebuilt multiple times, and it stands today as a modernized hotel with advanced facilities, bolstering a swimming pool and a tennis court, and has a total capacity of 312 visitors.

Hardanger Folkehøgskule/Hostel is, as its Norwegian name says, a combination of a hostel and a county college. This means that the hostel is only operational during the summer months, and has a total capacity of 86 visitors. Having suffered a fire in 1937, the main building was rebuilt, and is today, albeit still well-aged, considered up-to-date - by for instance offering wireless access to all visitors.

(a) Hotel Ullensvang [31].

(b) Hardanger Folkehøgskule/Hostel [17].

3.5.2 Calculation of a DEi-Score and Identifying Potential Gaps

Before being able to contact the selected hotels, we had to prepare the actual information that was to be communicated.

The Digital Economy index (DEi) Monitor is an online tool SNG has developed for analyzing its e-Solutions Benchmarking - which is the survey in this project. This tool was introduced in Section 2.4.3. Using data collected from the hotels and accommodations in the Hardangerfjord area, the DEi-Monitor provided a score that could be used for comparative assessment of e-solutions utilization of all the enterprises. In other words: the DEi-score quickly shows if the organization's Internet utilization is above or below the median DEi for the accommodations industry, quickly showing how each of the hotels are in relation to their peers.

In addition to calculating the DEi-score, some work had to be done in trying to assess and identify potential gaps and needs for the two accommodations.

As they have different dimensions in how they run their business, with one being a large all-season hotel and the other a summer-open hostel, the current usage of e-solutions and services was understandably quite different. After discussing with SNG, the researcher was to identify three areas for each hotel in which there was room for improvement, and work out solutions that could bridge their gaps. As this section only presents the research procedures, these suggestions were will be presented and explained when discussing the follow-up process in Chapter 3.5.

3.5.3 Construction of an Invitation

After the contents of the feedback were determined, it was necessary to construct an invitation to each of the two hotels. This part of the project was in fact dependent on positive answers from the accommodations to be able to proceed as planned. The goal was to carry out the "Promote Awareness and Adaption"-phase of SNG's Broadband Lifecycle - something that would become very hard to accomplish if there weren't any targets to promote this awareness to. A lot of effort was therefore put into designing the invitations, with a clear intent of keeping them short and concise, but still containing enough information to snare their attention. Together with project supervisor Thibaud Châtel, the CEO of SNG, Michael Curri, and SNG's marketing department, an outline and multiple drafts were put together and processed - before resulting in an invitation in the form of a pdf-presentation. One of the invitations that was constructed in this follow-up process can be viewed in Appendix E.

This phase of the follow-up process was both exiting and demanding, as it was such an important step in this project - with a lot of the future work depending on succeeding this task. Working hard and adapting to new ideas, and trying to perfect the invitations as much as possible was a matter of course, as everything being done in this project is a representation of SNG's business and reputation.

3.5.4 Communicating the Feedback

After doing all the necessary preparatory work, the next step was to contact the accommodations to hand over the feedback. Delightedly, both hotels accepted the proposals. Contact was made over telephone, where an agreement was made over when to carry out the meetings. An important aspect was to arrange a conference call between three parties: The hotel, the researcher and Thibaud Châtel - who was situated in Paris, France. By doing this, the researcher and M. Châtel could cooperate and play off each other while discussing the hotels results and our ideas with the hotel representative. What was communicated will be presented in Chapter 6, "Follow-Up Process to the Hotels".

3.6 Method review

The survey response rate from the accommodation enterprises can be seen in Figure 3.2.

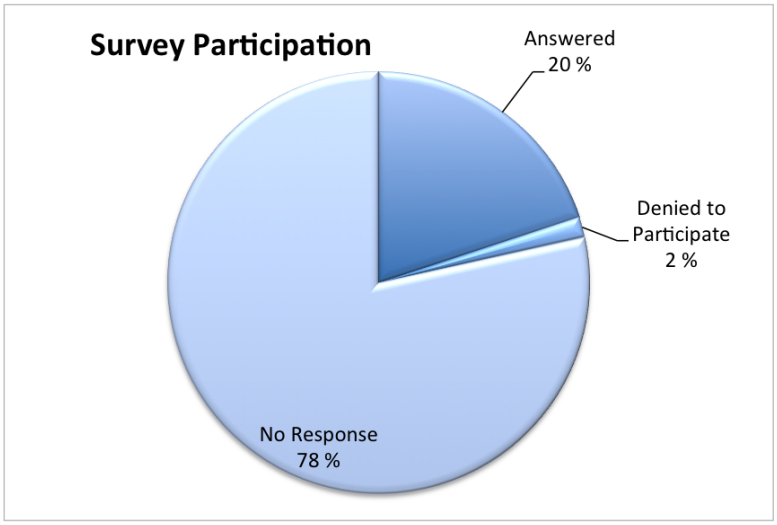


Figure 3.2: Overview of the Survey Participation [Stople, 2011].

After an extensive effort to persuade the accommodations in the chosen geographical regions to participate in the e-Solutions Benchmarking Survey, including periodic e-mail reminders and a large number of personal phone calls, the response rate for this survey landed on a respectable 20%. Being a university project from NTNU did turn out advantageous in several cases - as many admitted this project sounded exciting, and therefore wanted to contribute.

Taking contact with the municipality of Tromsø before the survey was launched, turned out to be a good move in raising the response rates. By mentioning in the e-mail enquiry, carrying the invitation to the survey, that Tromsø supported this research and that they would be handed the results of this project, drove the response rate in this region up to 32%.

The geographical deviations in terms of location in both in the American and Norwegian accommodations, have been disregarded when carrying out the results- and analysis phase of this project. Both markets are hence viewed as a unison representation of all its accommodation enterprises. This will, for instance, portend the non-separation of rural and urban areas.

In this paper, it is predicted that the population that has been collected in this benchmarking survey corresponds to the real population in Norway. The sample set that is collected is, when looking at the big picture, not a profound representation of the Norwegian accommodations sector. Therefore, if this set turns out to be inaccurate, as opposed to the nation's real population, the compiled results put forward in this paper may be somewhat imbalanced.

Chapter 4

Results from the e-Solution Benchmarking Survey

This chapter presents the results obtained from the e-Solutions benchmarking survey that was carried out in this project. The answers from the businesses that participated in this research on the hotel- and accommodation-sector in Lofoten, Oslo and Tromsø were added together to form a bundle, thereby representing "the Norwegian Market". SNG has over the last couple of years performed e-Solutions benchmarking on a great number of organizations and businesses in the United States, more specifically in the states of Kentucky, Louisiana, North Carolina and Virginia. In this project, a comparative analysis is carried out between the American- and the Norwegian market. Organizations in the category "Accommodations" in SNG's well-constructed and thorough database have been extracted, and their values bundled together to form a representative for the accommodations-sector on the US-market.

A selection of answers regarding broadband utilization in the accommodations-sector will be presented - such as current broadband connectivity, what barriers that might have been troublesome to overcome to be able to utilize the connection, and the importance of broadband Internet in providing organizational benefits.

In the following subsections, the Norwegian and the US market are compared to each other, showing what differences and similarities there might be in different aspects of broadband utilization in the accommodations sector.

It is important to note that the results are limited to presentation in this chapter, and that they will be further discussed in Chapter 5.

4.1 Type of Internet Connection

Accommodations in both the American and Norwegian market utilize a number of different access technologies as their primary Internet connection. Most of these are described in Section 2.2. Figure 4.1 shows the primary type of

Internet connection for organizations' in both Norway and in the US.

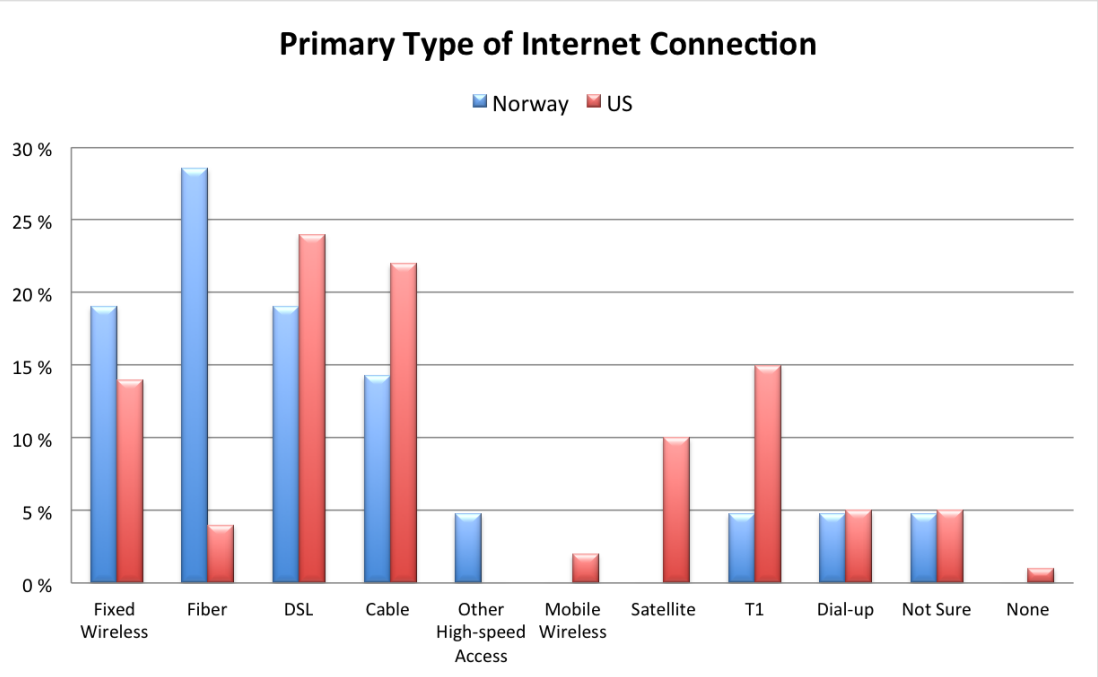


Figure 4.1: The organizations' primary type of Internet connection [Stople, 2011].

The Norwegian market has an overwhelming larger percentage of Fibre connections as their primary broadband access, as well as a larger share of fixed wireless connections. The US has a larger share of both DSL and cable connections. Satellite- and T1[1]-connections are used in 10% and 15% of the market of the US bundle, respectively. The Norwegian test area had very few representations of these technologies, with 0% for satellite and 5% for T1.

Looking at the time-period the organizations have had access to broadband Internet, there is some difference between the two markets. Although the major part of both the Norwegian and the US accommodations have had broadband Internet for more than five years, Norway with its 70% is currently 22% in front of the US. This time distribution is shown in Figure 4.2.

4.2 Current Utilization of the Internet

As the survey that was carried out in this project was called an "e-Solutions Benchmarking", a large number of the questions were quite naturally regarding the accommodations' current use of e-solutions and services that the accommodation can benefit from. Examples of questions could be if they are using

[1]T1 is a dedicated phone connection supporting data rates of up to 1,544 Mbit/s.

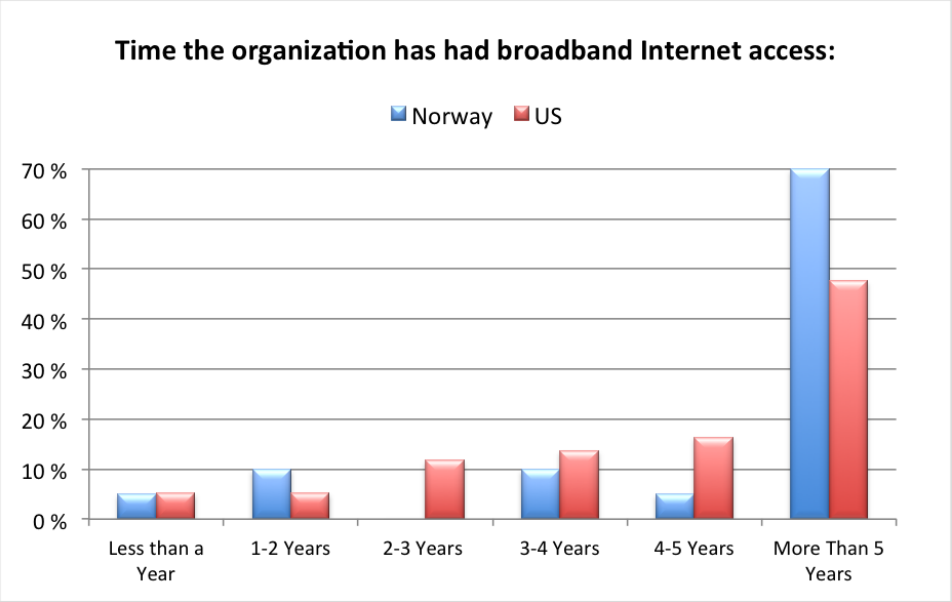


Figure 4.2: Time the organizations have had broadband Internet access [Stople, 2011].

the Internet to sell goods and services, if they host a website, access government information or if they use the Internet for staff training. Many of these e-solutions have been discussed in Section 2.3 in Chapter 2. Three areas of broadband services have been chosen for further examination. Figure 4.3 takes a look at the accommodations' current use of Teleworking, while Figure 4.4 shows how much weight the hotels lay on the utilization of social media networking when marketing their business and connecting to their employers. Lastly, we will look at the companies' use of e-Government services in Figure 4.5. In these questions, the accommodations were asked to identify the e-Solutions they were currently using or were planning to use in the next 12 months, or if they had no plan to implement the services at the current point in time.

The chart displayed in Figure 4.3, shows that Norway has a significantly higher percentage of accommodation-enterprises that currently uses teleworking in their daily operations. Interestingly, there are high percentages claiming that the practice of teleworking is not applicable for their business - with much as 43% claiming this.

The use of social media networking in a company's business was presented in Section 2.3.3.4. Figure 4.4 shows that both markets are starting to understand the possibilities that lie in the use of this e-solution, with over 60% saying that they are currently using this. Noteworthy is it, however, that almost a third (32%) of the US market either has no plan to use social media, or doesn't think its use is applicable to their company's business.

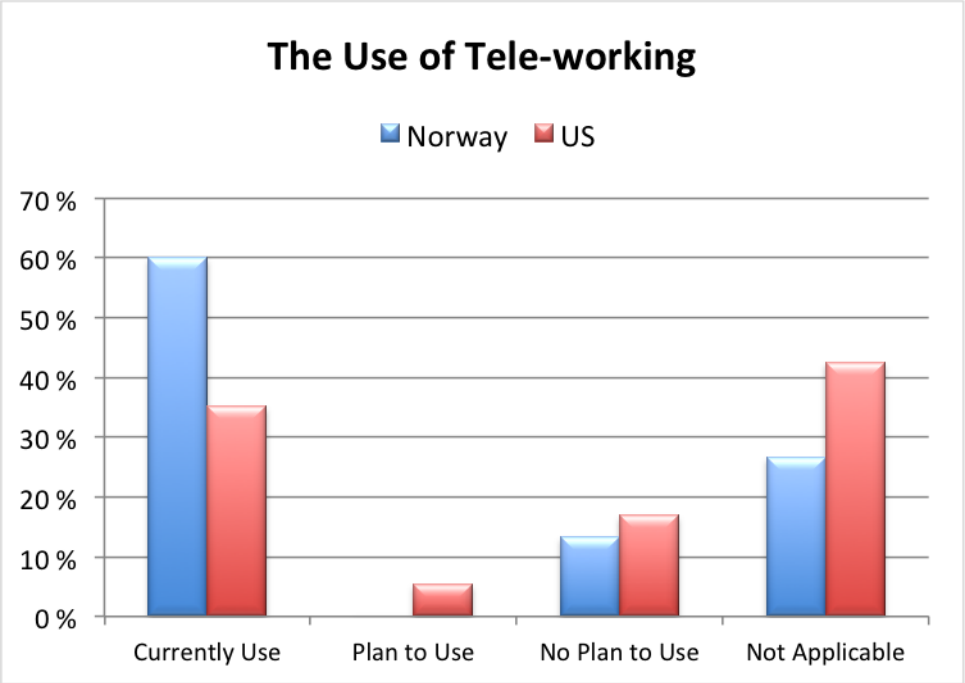


Figure 4.3: The current use of tele-working in the company's business [Stople, 2011].

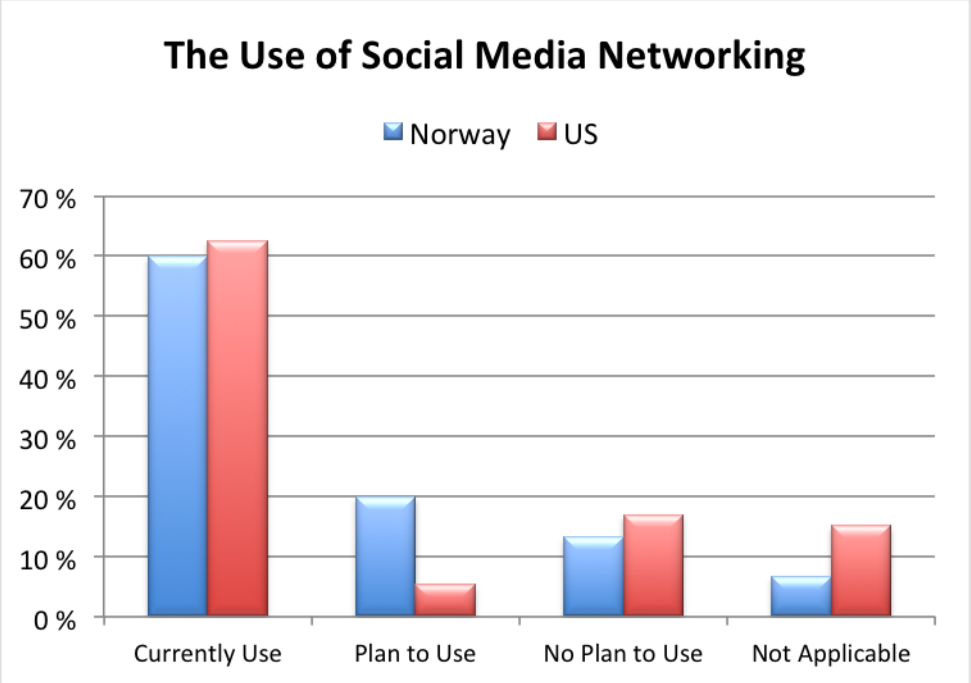
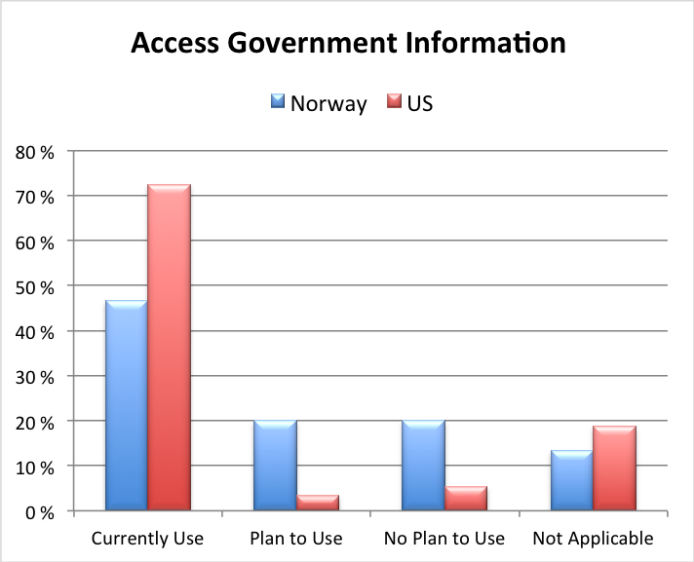
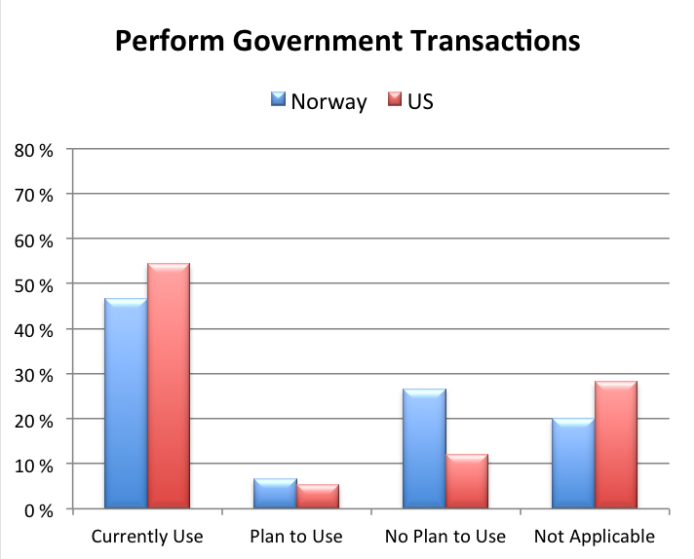


Figure 4.4: The current use of social media networking in the company's business [Stople, 2011].

Section 2.3.2.1 discussed the use of e-government to make the everyday tasks easier for the government employees as well as its citizens. Figure 4.5 shows two aspects of the use of e-government solutions from the business perspective: (a) shows how well the businesses use the Internet for accessing online Government information, while (b) presents how their current use of online government transaction systems is.



(a) Access government information



(b) Perform government transactions

Figure 4.5: The use of e-Government to (a) access government information and to (b) perform government transactions [Stople, 2011]

4.3 The Use of Web-Enabled Devices

The use of web-enabled mobile devices allows for work location flexibility for employees performing their work functions, enabling them to remain productive when not at their normal work location. Business travels and getting access from other organization or client locations are examples of this. For hotels and other accommodations, this might be to utilize a web-enabled phone to check e-mails for sometimes urgent customer requests while not at the office. Figure 4.6(a) shows the similarities in the Norwegian and the US accommodation enterprises when it comes to using laptop computers, equipped with wireless network cards, in their daily operations.

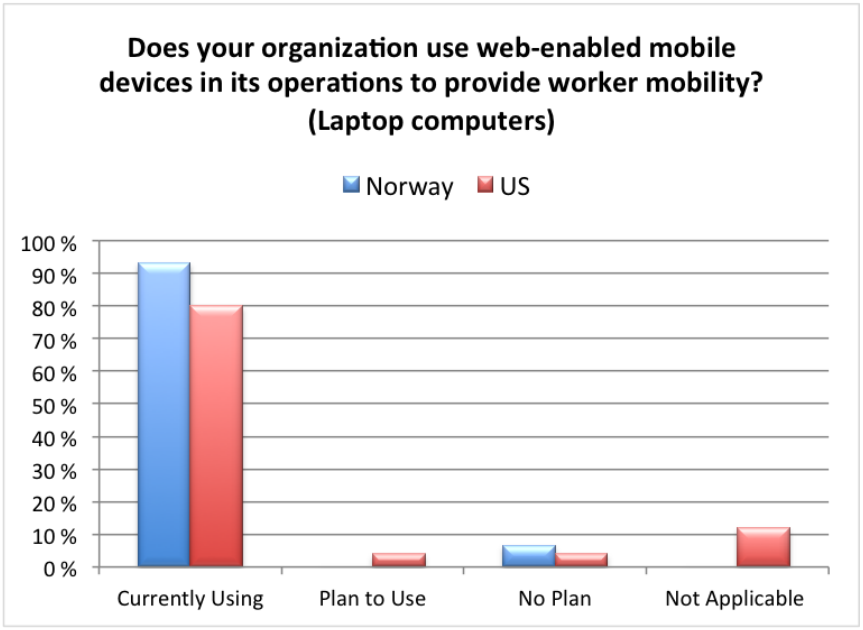
The comparison of the use of web-enabled mobile phones is shown in Figure 4.6(b). Both the Norwegian and the US market have a high percentage of accommodations answering that they are currently using laptops in their operations to ensure worker mobility. Worth mentioning, however, is the high amount (more than 30%) of enterprises in the American market that don't believe using mobile devices is applicable for their daily operations.

The organizations that answered that they were either currently using web-enabled mobile devices, or were planning to do so, were subsequently asked how important the use of these mobile were "for increasing the productivity and efficiency" in their own organization. Displayed in Figure 4.7 are the two countries' markets compared to each other.

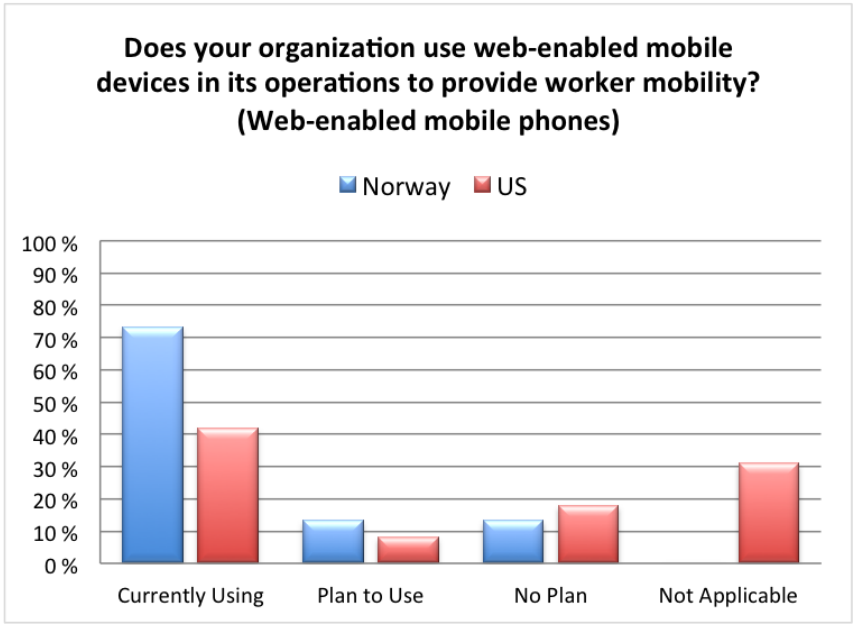
Standing out are the responses from the Norwegian enterprises, showing that 50% believe that the use of these devices are an essential reason for increasing productivity and efficiency. 36% claimed it was very important, adding up to a staggering 86%. None of the Norwegian accommodations said that this use was not important, nor not applicable. The responses from the US market were a little more scattered, but with 30% and 22% saying it was either essential or very important.

4.4 Barriers Preventing the Efficient Use of Broadband Internet

Barriers are any factors that limit or prevent the effective implementation or use of broadband capabilities. Some barriers are internal, such as internal organization resistance to change. Others, like the speed of the available Internet connection, are external barriers. In the survey, the enterprises were asked as to what degree different scenarios regarding usage barriers could relate to themselves. These barriers could be the lack of internal expertise and knowledge, uncertainty about benefits, privacy- and security concerns and the possibility of losing physical, personal contact with clients. Overall, the Norwegian accommodations were mostly neutral as to singling out possible barriers



(a) Laptops



(b) Web-enabled mobile devices

Figure 4.6: The use of (a) laptops and (b) web-enabled mobile devices in the company's daily business [Stople, 2011]

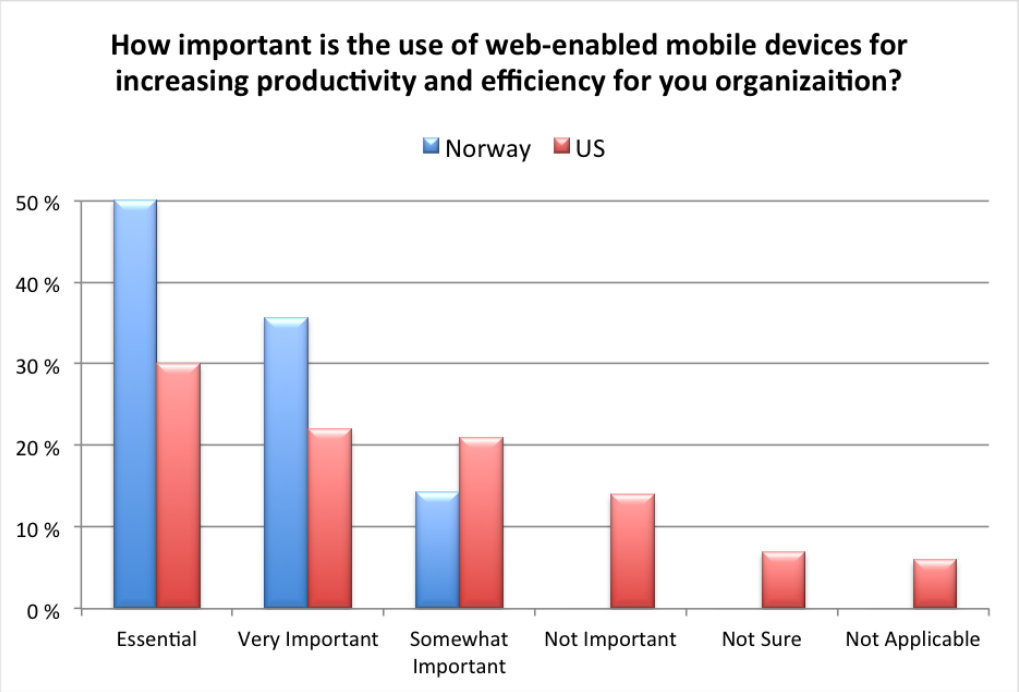


Figure 4.7: Importance of the use of web-enabled mobile devices for increasing productivity and efficiency [Stople, 2011].

that could prevent effective broadband usage. However, two potential barriers have been selected for further review.

As shown in Figure 4.8, both the American and the Norwegian enterprises feel that the lack of available experience and knowledge internally in the company can be a barrier to broadband success, with 52% of the Americans and 60% of the Norwegians answering that this scenario was either "Very Important" or "Somewhat Important".

Looking at the barrier regarding slow Internet connections, in Figure 4.9, 56% of the American and 53% of the Norwegian accommodations said that this was either a significant or very significant barrier they felt had to be overcome in order to utilize the hotel's full potential. 27% in Norway said that this was not a significant factor, while only 10% in the US claimed the same.

It should be noticed that a large percentage of the US market claim that these barriers aren't applicable to their business. In fact, it can be noted that this looks like an occurrence that is happening in several of the scenarios in this chapter. Often where the Norwegian enterprises have few or none claiming that a given scenario is "not applicable", the US accommodation-sector scores a fairly high value. Some thought regarding the case of this will be discussed in Chapter 5.

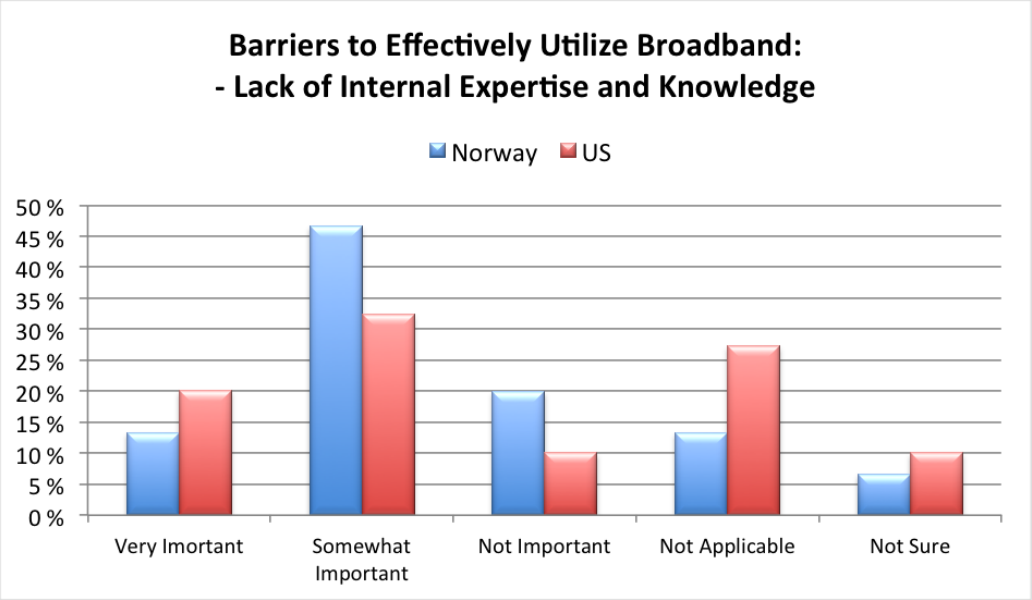


Figure 4.8: Barriers to utilize broadband Internet effectively: Lack of internal expertise and knowledge [Stople, 2011].

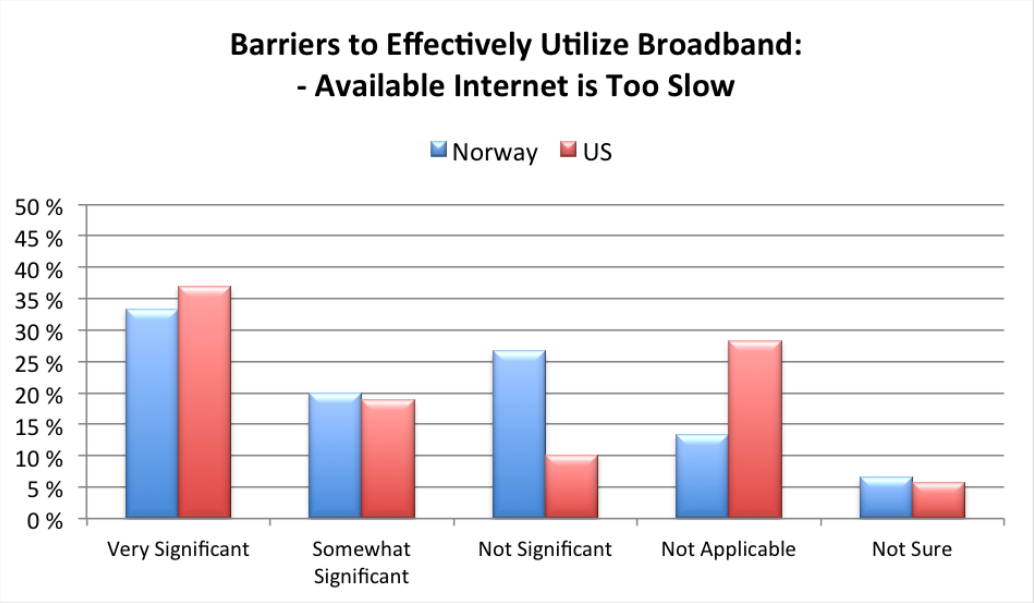


Figure 4.9: Barriers to utilize broadband Internet effectively: The available Internet is too slow [Stople, 2011].

4.5 The Importance of Internet in Providing Organizational Benefits

As was explained in Section 2.3, when compared to having limited access or no Internet at all, broadband can bring many benefits to individuals, enterprises as well as to a society as a whole. One of the views both the Norwegian and the US market seem to share is the importance of using the Internet to reach out to new customers and clients. Figure 4.10 shows that almost the entire bulk of the survey representation in both markets find the use of the Internet very important for this objective.

Since the hotel- and accommodations focus most of their business on customer service, seeing that their very existence is based on paying guests wanting to stay at their premises, we also wanted to see how important the Internet's role is in improving the service they can offer their customers. In Figure 4.11 we see that the results are very similar to the importance of reaching out to new clients, suggesting that both the Norwegian and the American enterprises have understood that the Internet can be of important assistance in the customer service field, and thereby aiding in the provision of benefits for the organization.

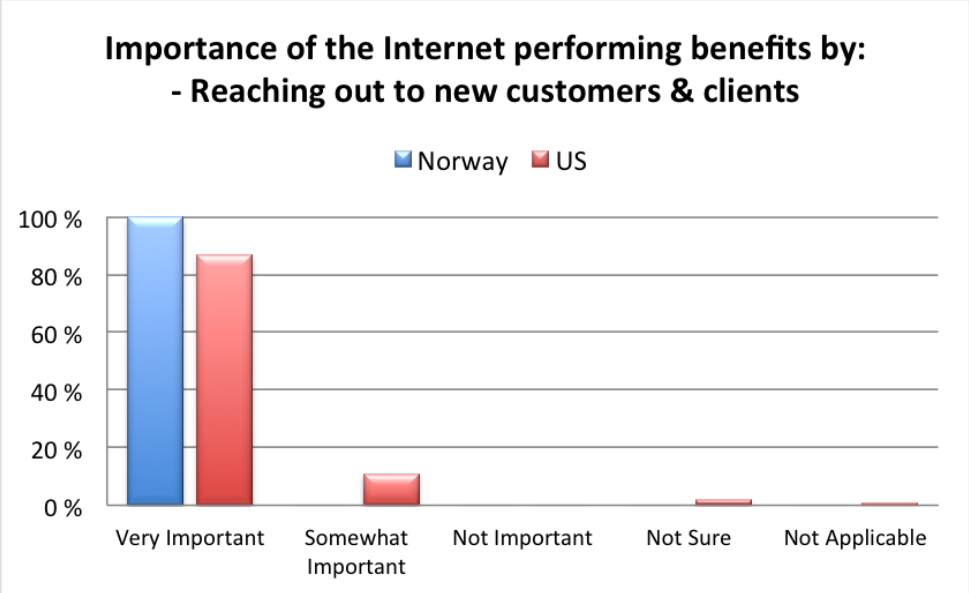


Figure 4.10: The importance of the Internet in reaching out to new customers [Stople, 2011].

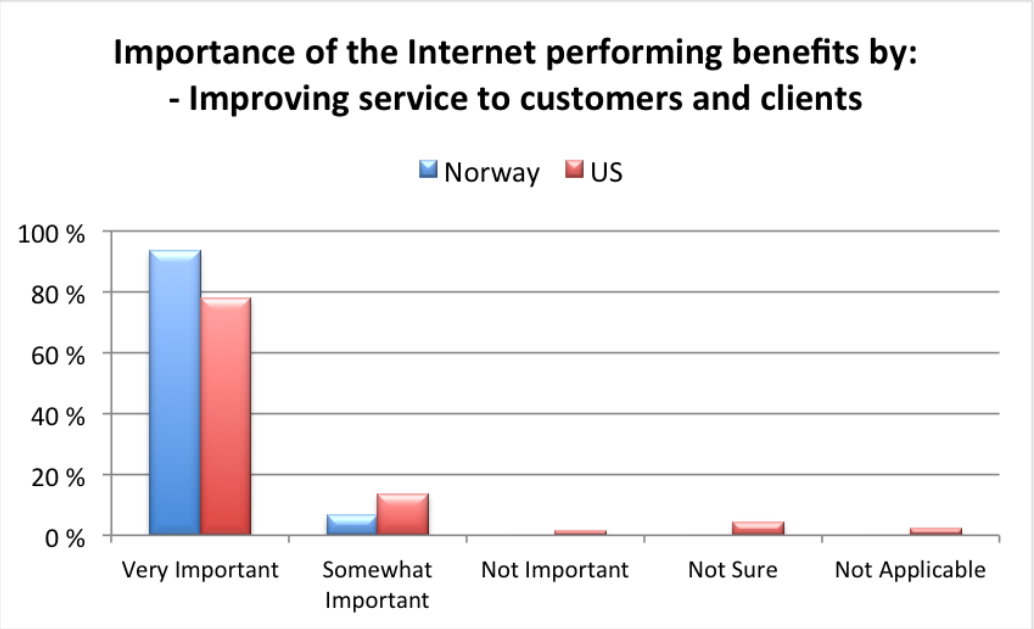


Figure 4.11: The importance of the Internet in improving service to customers and clients [Stople, 2011].

4.6 Acquiring Knowledge and Expertise to Handle e-Solutions

An important step before a business or organization can benefit from the use of broadband-based e-solutions, is being aware of their existence. As was mentioned in Section 2.3 when discussing the potential economic and social benefits that broadband can bring to the society, people won't be able to reap the benefits if they have never heard of them, nor if they lack the competence or skill to introduce what is necessary to achieve them.

With this is mind, the organizations were asked to identify their preference for acquiring the needed expertise and knowledge to understand e-solutions and the benefits that are accompanied by using them. E-solutions can range from the simple (online research, hosting an information website) to more sophisticated (online order processing, integration with supplier systems) ways of aiding the company's business.

The accommodations may prefer to acquire the needed expertise internally through hiring of new employees, or hand training to already hired personnel. Alternatively, they might prefer to use external resources that have the needed skills - e.g. hiring an IT-solutions expert on a contract basis. The last option might be to use external resources to support and compliment the business' internal skills.

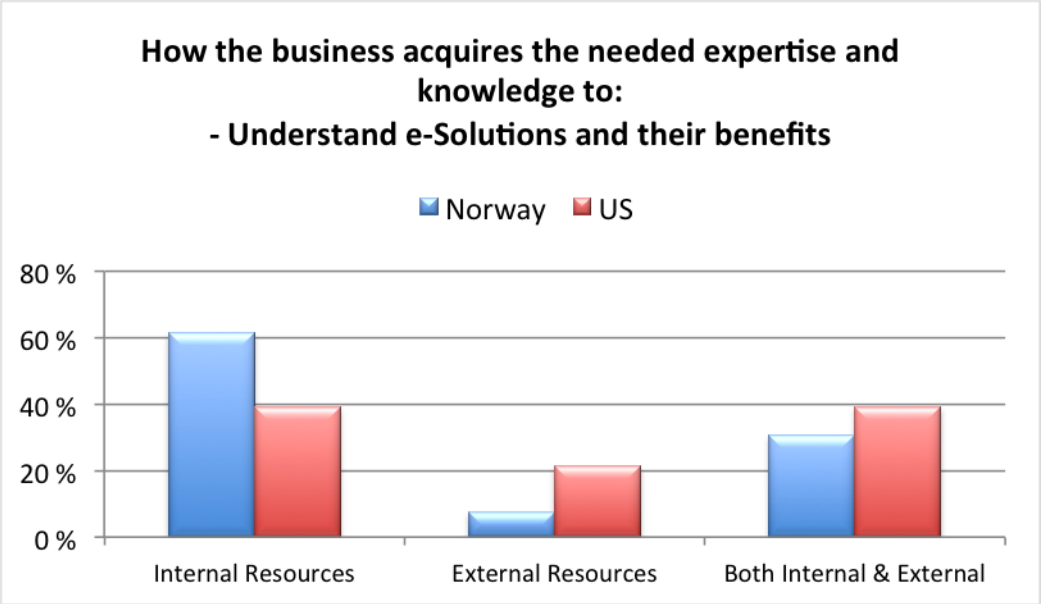


Figure 4.12: How the business acquires the needed expertise and knowledge to understand e-Solutions [Stople, 2011].

Figure 4.12 shows that 61% of the Norwegian accommodations utilize internal resources when trying to understand the range of available e-solutions. As little as 8% use external resources, and 31% use a combination of the two. In the American market, a larger share of the businesses leave the e-solution-understanding to external firms (21%), as only 39% handle this internally.

At this point, the reader may have recalled SNG's Broadband Lifecycle (Section 2.4.2). The importance of knowing what to implement and invest in when it comes to e-solutions, is essential to be able to reap the potential benefits. After identifying whatever needs, gaps and demands the enterprise might have, comes the time to promote this awareness and implementing the solutions. The hotels were asked whether they used internal- or external resources (or both) to implement the e-solutions they have decided to introduce. As can be seen in the chart in Figure 4.13, the Norwegian enterprises use internal resources a bit more than their American colleagues (54% versus 42%). In comparison to the matter of understanding e-solutions and their potential benefits, twice as many Norwegian accommodations use external resources for the implementation of the e-solutions. Here the Americans are fairly unchanged, actually charting a slight decline (down to 20%), indicating that they might have more a technical staff, rather than future-oriented, innovative expertise, available at the hotel. The amount of hotels that use a combination of internal and external resources is almost identical to the question regarding the understanding of e-solutions.

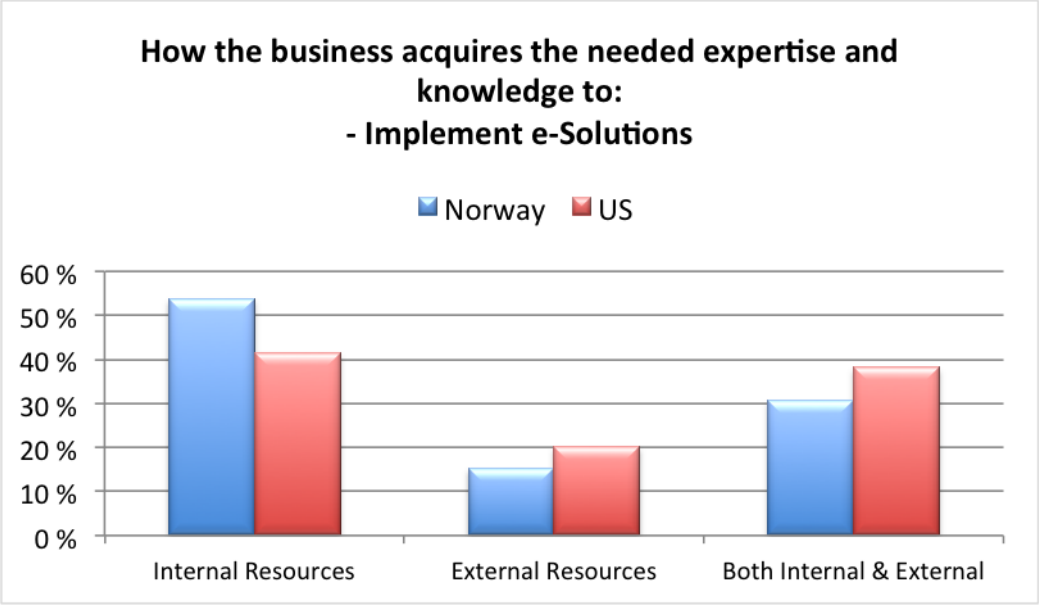


Figure 4.13: How the business acquires the needed expertise and knowledge to implement e-Solutions [Stople, 2011].

Chapter 5

Discussion of the Results from the e-Solutions Benchmarking

Having presented the results of the e-Solutions Benchmarking Survey in Chapter 4, we will now provide a comprehensive discussion about the selection of e-solutions that have been singled out. The following subsections will describe different scenarios regarding the accommodation enterprises' current utilization of the Internet.

5.1 How Are They Connected?

Recalling the figure that was presented in the beginning of Chapter 2 (Figure 2.1), one of the criteria to be able to make proper use of broadband services, is to have the necessary infrastructure in place. The natural place to begin the discussion of the e-Solution Benchmarking results on the utilization of broadband, is therefore the organizations' primary type of access technology. Figure 4.1 presented the results collected in the survey.

The amount of fixed wireless connections is a little higher in Norway (19%) than in the US (14%). A reason for this might be because of the Lofoten area that was chosen for the survey in Norway, which indeed can be described as a rural area. The anticipated income that follows from the deployment and upgrade to a high-speed, fixed broadband network, needs to exceed the initial deployment costs to make a network provider want to invest in an area. Because of this, the low number of potential subscribers might have limited the expansion of fixed broadband technologies in in some of the survey areas - with especially rural areas opting for wireless options.

Noticeable is the high percentage of fibre-connections in Norway compared to the US. 29% of the Norwegian accommodations revealed that they used this technology, which is presented in Section A.1.3. Interestingly, the Norwegian research population had a much higher percentage than what has been reported by OECD (as of June 2010) to be Norway's share of fibre connections (14%).

A reason for this might be something as simple as pointing out that OECD's statistics are nearly a year old, and that the Norwegian market has undergone great development since then. Another reason for this research population having more than double the percentage of the nations' average, is that two major cities were included in this research: Oslo and Tromsø - with the average urban population normally having a larger amount of high-speed connections than in rural areas. In comparison, the share of fibre connections in the US is only 4%. Looking at the figure, we notice that the US market instead uses "older" technologies, like DSL and cable. There are also a fair share on accommodations in the US market that still use the T1 technology (15%) - a technology that utilizes channels in the dedicated telephone circuits. This technology was actually released as early as in 1984 and it's safe to say that networks still consisting of technology really should be considered upgraded.

One out of ten connections in the United States are satellite connections. This might be a substitute for fixed wireless access in remote areas where the infrastructure might be underdeveloped, making satellite the only possible option to obtain a sufficient broadband capacity.

Overall, it looks like the Norwegian market has taken its development one step further than the American market, which is very similar to calculations published by the OECD [21].

Changing focus to Figure 4.2, we see that accommodations in the Norwegian market has on average had broadband Internet access for a slightly longer time period than their US counterparts. About 70% of the Norwegian accommodations have had broadband access for more than five years, while close to 50% in the US can say the same. However, the US market has almost 10% more enterprises than the Norwegian market saying they have had broadband for 4-5 years. This can reduce the gap somewhat, because we can't really be sure wether the enterprises in the 5+ year grouping have had their access for exactly five years or e.g. ten years. The bottom line can still be seen as was just claimed in the previous paragraph: that Norway, as of today, have developed their broadband infrastructure further than their American counterparts.

By combining the bandwidths for each of the access technologies, that were presented in Section 2.2, with their respective market shares (based on the survey populations) of the broadband technologies in the two countries, we can view the country's total broadband access by an indicative, mixed bandwidth. An overview of the mixed bandwidth in Norway and the US can be seen in Figure 5.1, and does once again underline Norway's current lead on the US accommodations sector when it comes to the use of high-speed broadband technology.

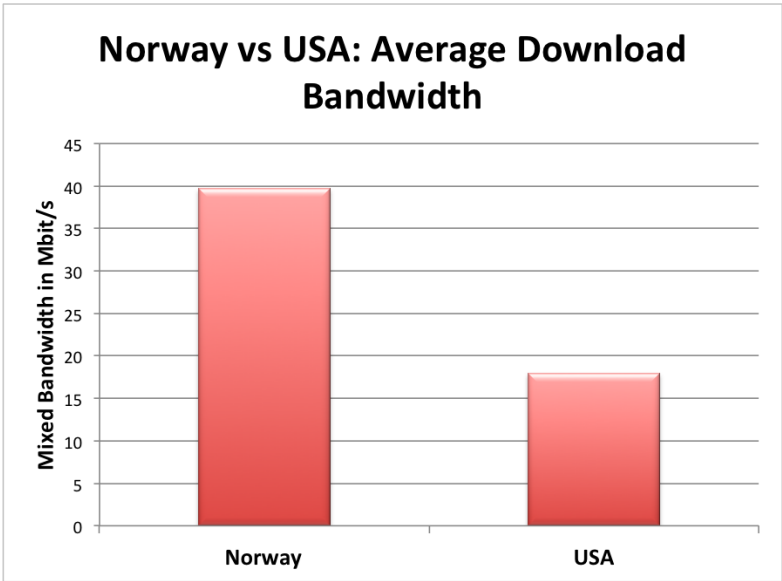


Figure 5.1: Average download bandwidth: Norway vs USA [Stople, 2011].

Such an estimation favors countries with a well-deployed optical fibre network that can deliver high bandwidth to a great number of people. As more companies attach themselves to the fibre-optic backbone network, the average bandwidth in these countries will only continue to grow over the next few years.

5.2 How Do They Utilize the Internet?

The introduction of high-speed broadband Internet has created many new possibilities for organizations and businesses to enhance their operating functions and processes. The matter of e-solutions was introduced and explained in Section 2.3 when describing what benefits broadband can bring to a society. They can enable an enterprise to integrate the use of computers and systems to carry out both simple and complicated online tasks. Among the easier tasks may be to do online research or to put up a website, while the more complicated e-solutions can be to offer the processing of online orders and transactions, or to utilize rich media content on websites. Some examples on the businesses' current utilization of the Internet, presented in Chapter 4, were the use of tele-working and social media networking, and the business' current use of electronic government services (e-Government).

Figure 4.3 showed the current use of tele-working in both the American and Norwegian accommodations sector. Norway scored an impressive 60%, while only 35% of the US enterprises said they were currently offering this. Tele-working can, as explained in Section 2.3.3, bring great benefits to an enterprise when it comes to employee satisfaction. Effectiveness can be improved by

performing urgent work-tasks from the home, instead of having to travel to the workplace. Tele-working can also bring benefits to the society with regards to the environment, as more less workers use their cars to drive to work, which leads to less pollution and traffic congestion.

The high percentage of enterprises in the American sector claiming that tele-working was not applicable to their business, was mentioned in Chapter 4. This obvious ignorance can actually be traced to many of the questions regarding the use of e-solutions in this survey. It seems like far too many accommodations are unaware of the possibilities that lie in the utilization of broadband services. Reasons for this ignorance may be that the accommodations are satisfied with how things are done in the present, and that they haven't had a reason to look for areas of improvement in their business yet. They might be used to, or even enjoy, doing tasks in "the old way", as following one's safe routines is simply the nature of many people. The accommodations sector is indeed a sector that relies on the staff showing up at the workplace and greeting customers in person, and this might be a reason why so many in this survey don't think tele-working, as well as several other e-solutions, are applicable. It should be noted that the use of tele-working should still be of interest to all businesses, independent of industry. It is only a matter of adapting it to the company's business properly, even if it only implies the ability of storing company information and documents online (in the clouds) so that work can be accesses from wherever, whenever.

Social media networking was explained in Section 2.3.3.4, and the survey responses to the use of these Internet applications were presented in Figure 4.4. Both the Norwegian and US market show off good scores, especially when pairing the "Currently Use" and "Plan to Use" groupings. The use of social media networking in businesses is fairly new marketing method, and it is good to see that so many have joined this trend, or are planning to - as the possibilities in this area are probably just going to grow in the coming years.

The government's use of e-services can have an impact on both itself, as well as its businesses and citizens. Having access to government information online, as well as being able to perform government transactions online, eliminates the time being spent traveling back and forth to the government agencies, it reduces the time and costs related to sending information by snail mail, as well reducing the expenses being used on paper and postage. Looking at Figure 4.5, we see that the American market has a much larger base saying they are currently using the Internet to access government information. To access government information can imply to browse the government website for information, as well as submitting requests or downloading forms or applications. Adding the planned uses and the current uses together, brings Norway much closer to the US market, showing their intent to make use of these services in the near future.

The US market still has the upper hand on the Norwegians when it comes

to performing government transactions. While approximately the same number of Norwegian enterprises that access government information also perform online transactions, the US market sees a drop from 72% to 54%. Performing government transactions can be to perform payments or submit government forms online. It should again be mentioned that a large number of enterprises don't seem to think that using e-government solutions is applicable for their business. After having explained e-government in Section 2.3.2.1 in Chapter 4, it should be clear that this is an area of e-solutions where benefits can easily be achieved.

5.3 Do They Use Web-Enabled Devices to Stimulate Mobility?

By using web-enabled mobile devices, a company introduces the element of flexibility of work location for employees performing their work duties. It also leads the employees to remain productive even though they might be away from their normal work location. Areas where the employees can benefit from broadband mobility might be while on business travels, when wanting to obtain access while at other organization- or client locations, when the worker is at home, or in fact in any other situation when the workers are away from their office.

As Figure 4.6(a) shows, both the Norwegian and US markets make use of laptop computers to ensure mobility for their employees. 93% of the Norwegian enterprises state that they use laptop computers, while 7% say they don't have any plan to use them at all in the near future. A reason for this might be that several accommodations in the Norwegian sector are small enterprises that are being run by a sole employee. The US-based hotels have a very high usage rate as well, although 1 in 10 don't feel that this kind of equipment is applicable for ensuring their workers' mobility.

If we look at the use of web-enabled mobile devices, we see a much clearer difference between the two. Combining the "Currently Using" and "Plan to Use" categories, the Norwegian research population form an impressive 84%, reflecting their willingness to use web-enabled phones to increase their worker's mobility. It is indeed quite understandable, as it is a great advantage to be able to, for instance, check for new e-mails or requests while on the move - both inside the hotels' premises, as well as outside it. It is time effective, meaning other things can be done in the time that gets freed up. The US sector can display a bundle of 50% on the similar question, while as many as 31% actually claimed that the use of web-enabled phones weren't relevant for their line of business.

These two scenarios show again that the US might not have come as long of a way in the broadband development process as the Norwegian market. It can

even be interpreted as to that the staff at these accommodations don't have enough knowledge regarding the possibilities that ICT-devices and broadband can bring to a business. Even though the technical elite in these two countries may very well offer close to everything there is of top-notch Internet applications and services, it seems that too many don't realize how they can really benefit from the Internet and its services. This includes, as we have just seen, the use of mobile devices to do business related work while on the move. It it obvious that the use of these devices requires a wireless broadband connection at the workplace, as well as outside it. This does indicate that there has to be a sufficient wireless infrastructure in place in the local community to be able to utilize these devices to the full.

5.4 What is Preventing Effective Broadband Utilization?

Barriers are any factors that limit or prevent the effective implementation or use of broadband capabilities, and they can vary greatly between companies. Some are internal, such as internal organization resistance to change, while others may be external, like the available speed of the Internet connection.

Both the American and Norwegian survey population had some concerns regarding these kind of barriers. Again recalling the conditions that are necessary to be able to achieve economic and social impacts from broadband use (Figure 2.1), the business needs a foundation based on both infrastructure and readiness. It is when these elements are in place that broadband services be properly used. Figure 4.8 shows what the responses were when asked if the lack of internal knowledge and expertise were preventing them from discovering and utilizing their broadband connection efficiently. 13% and 20% of the accommodations in Norway and the US, respectively, said this was a very important factor, indeed. Recalling that the businesses that have been questioned in this survey are hotels, bed & breakfasts, fisherman's shacks and other kinds of accommodations, one can understand why some of them may not have this kind of knowledge available internally. Some of these accommodations might be operated by just a couple of persons, or they might be part of a family business that has been handed down through generations. These might very well be aware of some of the benefits, but need external help to acquire and implement these solutions. The acquiring of knowledge and expertise will be discussed further in 5.6.

As many as 47% of the Norwegian businesses, and almost one third of the American, claimed that the lack of internal resources was somewhat important. This may reflect that they are aware of some of the e-solutions that are out there, and maybe they have managed to implement some of them as well. They do, however, need to seek external help to discover the whole range of

e-solutions that can help their business provide further economical and social benefits. The introduction of stronger broadband, accompanied by the constant inventions of new and innovative Internet services, is exiting in many ways. It is therefore important for business managers today to stay on top of the developments that are taking place in our digital world. Educating the staff at the hotel is a possibility, as this would help them overcome basic issues that might contribute in the hotel employees fully understanding the available broadband connection.

Another potential barrier that was selected from the survey database, and that was presented in Results, was the question regarding if their available Internet was too slow for them to be able to fully utilize their the e-solution possibilities. Just as with the previous barrier, was this one selected to illustrate the importance of having an infrastructure in place to be able to achieve many of the desired benefits. Looking at Figure 4.9, it is clear that both the Norwegian and US market think this a very significant barrier (33% and 37%, respectively). It is in fact quite noteworthy that over a third of all the surveyed enterprises claim this. Reasons for these responses might be that a large amount of the survey participants are situated in rural areas, as is the case with the Norwegian survey population from the Lofoten area. It may also be that the available e-solutions on the market require a higher bandwidth than what is currently available at their level of broadband development. The deployment of high-speed network can therefore be seen as a very important step to fulfill the potential in the market today. As a third of the accommodations-businesses in this survey feel that their operations could be performed better with a better Internet connection, it is clear that the local community or government needs to step up their efforts to help bridge this gap. Although the upgrade of the access technology is surely a costly investment, the benefits that can be achieved, not only for the individual businesses, but also for the society as a whole, are undoubtedly greater in the long run.

5.5 What Benefits Do They Seek from Broadband Utilization?

An issue that was selected for presentation in the results of the e-Solutions Benchmarking, was the rate of importance the company felt that the Internet could have in providing benefits. The first question was how important the Internet was in reaching out to new customers and clients.

Figure 4.10 show that both markets feel the Internet is very important in this matter, and most of the remaining respondents feel that its impact is somewhat important. Interestingly, every single one of the Norwegian accommodations answered "Very Important". The results are understandable, as most people that are planning a vacation use the Internet when browsing for

suitable lodging - and every accommodation with a nose for business would want to make themselves available for this purpose.

As the accommodations sector is truly a service sector, it is interesting to see how important the hotels feel the Internet is for improving service to their customers and clients. The chart in Figure 4.11 displays very much the same results as when reaching out to the clients. What can be questioned is, however, the reason for the remaining accommodations only stating that the Internet is only somewhat important to improve customer service. In todays world, it is difficult to imagine a business without information about itself available online. The use of ICT and broadband in recent years have made it difficult for those who still solely rely on telephone or paper advertisement to tempt customers. They simply risk falling behind, and losing potential customers to their competitors. Having information easily available online is a huge advantage in todays market, and it is just as important to be able to provide answers to customer requests online, either in form of providing online information, answering e-mails or handling other requests.

5.6 How is e-Solution Knowledge and Expertise Acquired?

When discussing potential barriers to efficiently utilize the Internet and its services, it has been mentioned that not all businesses have the required internal knowledge to successfully obtain the benefits that e-solutions can provide them. If we take a look at Figure 4.12 we see that most of the Norwegian Accommodations use internal resources when trying to assess what e-solutions are beneficial for the company. A reason for this might be that many of the hotels that participated are part of a larger hotel chain, being provided with the necessary IT-expertise. We also see that many hotels choose to get some external help in addition to having some expertise available internally.

When it comes to implementing the e-solutions, there are only slight changes in the responses from the accommodations. It should be noticed that some of the hotels that were self-sufficient when it came to identifying the potential e-solutions, opt to use external resources when implementing them. This is at least the tendency in the Norwegian market, as the US market seems quite unchanged between the two charts. The acquiring of external help is also called outsourcing, and is simply put the decision for a company to entrust parts of its activities to another company. These external resources can be independent IT-experts, or firms, that base their existence on contract work for larger enterprises. This is often the case with smaller accommodations, who don't have the necessary resources to hire an IT-manager in a full time position. An example of external IT-resource will be given later in this chapter, when describing the follow-up process that was carried out in this project.

Chapter 6

Follow-Up Process with the Hotels

As an integral part of this project, calculated feedback was to be given to a selection of the hotels that took the time to answer the e-Solutions Benchmarking Survey that was carried out. When explaining the research procedure in Chapter 3, it was mentioned that two hotels from the specialization project, carried out in the Fall of 2010, were selected for this follow-up process, namely Hotel Ullensvang and Hardanger Hostel. This chapter will present what suggestions were made to these accommodations, all with the intent of aiding them to improve their current utilization of Internet-based solutions and achieve social and economic benefits for the company.

6.1 Identifying the Needs and Gaps

Several opportunities were identified for both hotels in order to improve the accommodations' e-solutions utilization, and these were communicated to representatives of the two hotels by performing online conference calls. This follow-up process was an integral part of this project, and is an important phase in SNG's Broadband Lifecycle, which was described in Section 2.4.2. The purpose of this "feedback"-step was to identify needs and gaps in the hotels' broadband utilization, and communicate these in an attempt to help them bridge these gaps and to harvest both social and economical benefits. The table below, Table 6.1, gives an overview of the suggestions that were made to the two accommodations.

In addition to presenting these ideas to the accommodations, they were given feedback in form of a DEi-score. This is a score generated by one of SNG's business intelligence tools, and is a quick way for companies and organizations to assess their current level of Internet utilization relative to their peers. As SNG's DEi-score was presented in Section 2.4.3, and Chapter 7 will give further discussion on this analysis tool, the following section will only present the

Table 6.1: Suggestions of improved use of e-Solutions to the two selected hotels in the feedback-process.

Hotel Ullensvang	- Propose the implementation of a customer review page. - Improve customer service by setting up a Skype account. - The adoption of online training methods. - Video of hotel and its activities on e.g. YouTube.
Hardanger Hostel	- Introduce teleworking. - Video of hotel and its activities on e.g. YouTube. - Utilize social networks and online marketing. - Introduce online training methods. - Set up an independent web-page for the hostel.

different e-Solutions that were proposed to the two accommodations.

6.2 Describing the Selected e-Solutions

The broadband use of the two accommodations were, as mentioned above, analyzed separately as a result of their responses to the e-Solutions Benchmarking Survey. Here, we will take a closer look at each suggestion that were made to the hotels, explaining the importance and possibility of each of the solutions as we go along. Worth mentioning is that most of these suggestions for improved use of e-Solutions have already been described in Section 2.3, "Benefits of Broadband in the Society".

Being substantially different in both size and available resources, and with one of the hotels only being active in the summer season, the content of the feedback to the two hotels were bound to be somewhat different. An important factor was, however, that each of these accommodations would receive a tailored feedback based on their given needs, in order to best help them understand how to adapt to the ever-evolving world of broadband technology.

Hotel Ullensvang

Hotel Ullensvang impressed in the e-Solutions survey, scoring in the very top among its peers, and clearly understanding many of the benefits that can be achieved by using broadband. There was, however, some room for improvement in their daily use.

As the website is one of the first things a potential customer discovers and investigates when choosing which hotel to stay at, often selecting from a multitude of different options, it has to convince the customer that this hotel is their best choice. Although already having a fairly flawless website, the suggestion of introducing a customer review page was made to Hotel Ullensvang. This is a great way for people to see what other guest have to say about their experience with the hotel. When customers book their stay at the hotel, they often get asked to provide their e-mail address. By storing these e-mail addresses in the hotel database, an e-mail can easily be sent out to the customer a few weeks after their stay, politely asking if they were satisfied with their experience, and if they would mind to write a short review. Making a selection of these feedbacks available on the homepage would act as a great advertising for the hotel.

The second suggestion was for them to consider setting up a Skype-account for the hotel. By doing this, they would be able to create a new possibility for potential customers to get in contact with them by using VoIP technology (discussed in Section 2.3.3.1). For customers based abroad, a potential barrier might be the extra rate that may apply when making international phone calls. Of course, a way to bridge this barrier easily is to send an e-mail, but there are still many people in the world that prefer to communicate by voice. Skype is a free option for doing just this, and by providing the necessary contact information on the webpage, the hotel could improve their customer service.

Also, a way of showing customers what the hotel is really like, is to include a video of the hotel and the activities that can be carried out during a stay there. Hotel Ullensvang was already utilizing a wonderful rich media application showing 360 degree views of selected areas in the hotel as well as linking to a YouTube video showing the view to the fjord. Trying to find ways to improve this a little bit more, the author and SNG suggested them to make a video where they walk-through the hotel, talk to the owners and show some of the activities that can be done - both at the hotel as well as in its surroundings. All in an attempt to utilize the Internet, and to maybe provide them the extra edge that is needed to stay ahead of their peers. Pictures can do wonders in advertising, but to see how things are in real life is something that should be rated as well.

Our last suggestion was for the hotel to adopt online training methods. When talking to the hotel's IT-consultant, Geir Midtun, he kindly explained that they were indeed using online methods for educating their staff, but that they until now had been somewhat limited by an insufficient broadband connection. They were, however, going to upgrade their broadband connection to fibre-technology over the summer, giving them a lot more options and possibilities to achieve benefits in this area. As a last advice, we asked him to consider online-interviewing when, for instance, hiring part time, seasonal employees. With a two hour drive by car to the nearest railway station, and a three hour

drive to the nearest airport, the use of videoconferencing when hiring would enable them to save costs on bringing people in for interviews, and would most likely get more people to apply - as the investment of the applier in this case would be minimal.

Hardanger Hostel

Hardanger Hostel was the smaller of these two accommodations. They are only operative in the summer season, acting as a hostel aiming to provide travelers seeking an affordable lodging, with the basic necessities needed on their journey. In fact, their main business is being a county college during the rest of the year. They did score lower on SNG's DEi ranking than Hotel Ullensvang, but they focus their business on a different clientele. By indeed being a hostel, their broadband needs are understandingly not as substantial as is the case of Hotel Ullensvang, who aim to be a more luxurious accommodation. The potential for Hardanger Hostel's broadband utilization was intriguing for the NTNU/SNG-team, and several suggestions were listed up in an attempt to easily bridge some of the gaps that became apparent when analyzing their e-Solutions Benchmarking results.

In the survey, they said that they at the moment weren't utilizing teleworking in their daily business. They were, however, planning to use it in the near future, and we explained to them a little bit about the benefits that could be achieved by introducing this e-solution to the hotel's business. Since they are a small business with few employees, at least in the summer, the use of teleworking can be of great advantage. E-mails and phone calls can be received and read when not at the hotel, providing faster responses and making themselves more available to potential customers.

The Hostel part of their business uses an external website to promote the accommodation and to receive online bookings. Although this might very well be a cost-effective way for them to do their business (with them being a fairly small enterprise), we asked them to consider putting up a website for the hostel - containing information about the hotel and its activities, as well as pictures and videos of the Hostel and the surrounding area. As the county college part of their business has such a website, little would have to be done to include a section or underpage describing the hostel - thereby making it easier for potential customers to learn about them.

Like was proposed to Hotel Ullensvang, we wanted them to include a videoclip of the hotel and its surroundings for the same reason as mentioned earlier: to give the hostel a competitive edge by showing people how it's like in real time. Another suggestion that was similar to Hotel Ullensvang, was the introduction of online training methods. Being localized in a rural area in the Hardangerfjord, online training can be lead to savings in cost - as this prevents employees to travel in order to receive training (or people traveling to the hos-

tel to educate). Setting up an online training solution could provide benefits for the county college as well, as teachers are sure to appreciate this solution if given the opportunity.

Lastly, we mentioned that they should consider introducing the utilization of social media networking. The possibilities that can arise from this range of e-solutions was mentioned in Section 2.3.3.4. They already have an online customer review page in their co-operation with the external website-provider (which is an international hostel site), but creating, for instance, a Facebook page could reach out to many more potential customers. The number of Facebook users is constantly increasing, and having information about the Hostel available on this social media site would only be of benefit for its business and reputation.

Chapter 7

A Broadband Utilization Score

One of the core aspects in this research paper is the businesses' utilization of Internet-enabled applications, so-called e-solutions. Chapter 4 and 5 examined several elements of broadband utilization separately, ranging in topics from type of connection to the use of social media networking. Although interesting to analyze these results individually, it is appealing to construct a way of viewing these results as a whole - generating some sort of total result-score.

SNG has developed a business intelligence method for analyzing the e-Solutions Benchmarking that was performed in this project. The results collected from this survey, gets analyzed and produced into a score called the Digital Economy index (DEi). This index will be shown in the following subsection. In addition, an independent index has been calculated based on the same, retrieved responses from the accommodations in the performed benchmarking survey.

7.1 SNG's DEi-Score

SNG's DEi calculation was introduced in Section 2.4.3. Using data collected directly from the accommodations in the survey, a DEi is calculated from weighting the individual hotel's uses across 17 utilization categories, and normalizing the DEi on a scale of 0 to 10. The DEi-score is then aggregated across a group organizations of similar characteristics - in this case other hotels, bed & breakfast's and camping cites - to derive the range of DEi's, as well as the median DEi for the same grouping or industry (here the hotel- and accommodations sector).

Figure 7.1 displays the DEi-score that SNG's Digital Economy Index Monitor calculated for Hotel Ullensvang during the course of this project.

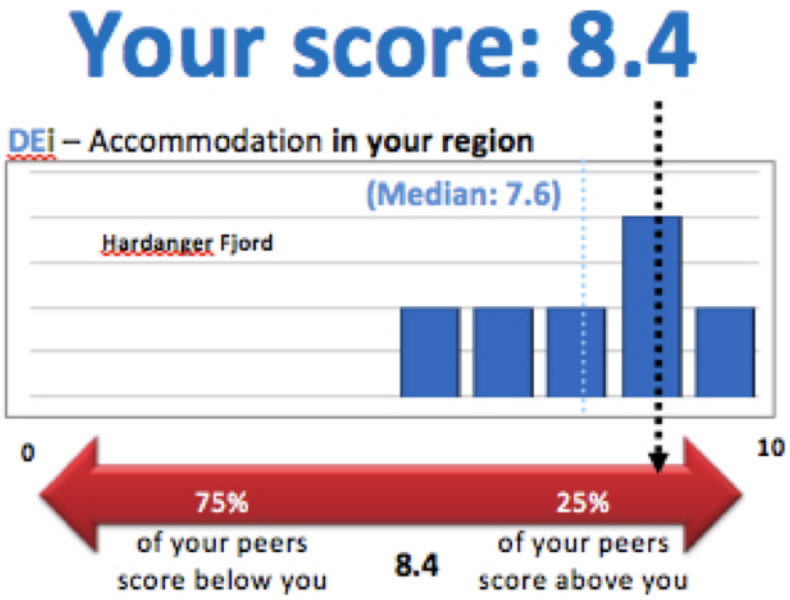


Figure 7.1: DEi-score calculated by SNG for Hotel Ullensvang [15].

Scoring an impressive 8.4 shows that Hotel Ullensvang clearly are aware of what the use of broadband-services can bring to the hotel's business. They are above the DEi-median of 7.6 for the Hardangerfjord-area, and are on a more advanced broadband utilization level than 75% of their peers.

As previously reviewed and discussed in this paper, an e-Solutions Benchmarking Survey was carried out in the Lofoten, Oslo and Tromsø areas during the course of this semester. Based on the individual responses, a personal DEi-score was generated for each of the accommodations that were surveyed. For comparative reasons, the accommodations in each of the geographical areas mentioned above, were pooled together in order to show the average DEi-level in each area. In addition to Lofoten, Oslo and Tromsø, the DEi-average of the Hardangerfjord-area has been added as well. This area was surveyed as part of the specialization project that was carried out in the Fall of 2010, and is recognized as an important tourism area in Norway as well.

Earlier in this paper, in Chapter 4 and Chapter 5, comparisons of the broadband utilization between Norwegian and US accommodations has been performed. Here, we will continue this comparative analysis by reviewing the DEi average from a selected geographical area in the US, namely the Commonwealth of Virginia. This state, the 12th largest in the US with a current population of 8 million, was surveyed in September 2010.

Figure 7.2 shows the DEi-scores from the selected geographical areas:

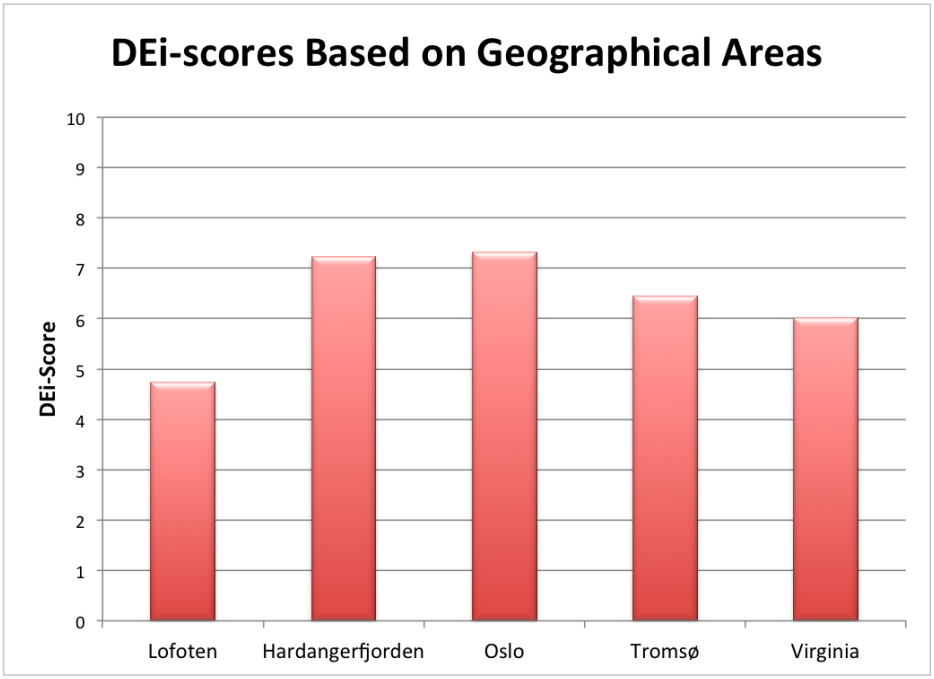


Figure 7.2: Avereage DEi-scores in the Hotel- & Accommodations-sector based on geographical areas [Stople, 2011].

Being able to score a maximum of 10 on the DEi-scale, Oslo is the area that reaches the highest level of broadband utilization, with an average of 7,33. Hardangerfjorden comes in right behind, scoring an average DEi-score of 7,23. This is rather impressive, considering that the Hardangerfjord is a quite rural area. On the other hand, being located quite remote from their clients and many suppliers, these accommodations seem to have realized that broadband can be their connection to the rest of the world.

Tromsø come in third in this rank, with a DEi-score of 6,46. Seeing as this is an urban area, as Tromsø is one of the major cities in Norway, the reason for them scoring fairly high is natural. Urban areas have had a tendency of acquiring high-speed broadband at an early stage, and therefore they have had longer time to adapt and adjust the use of e-solutions. There is, however some room for improvement in this area, as there is no reason they should receive a lower DEi-average than their colleagues in Oslo and Hardanger.

The Commonwealth of Virginia score only slightly lower than Tromsø, with a 6,02, showing that this US state is rather well developed when it comes to broadband development and e-solution usage. Covering a large number of accommodations, this area contains hotels in both urban areas and more rural areas, somewhat justifying that it scores lower than the first three Norwegian areas.

The area with the lowest DEi-average in this survey comparison, is Lofoten. This survey area consists of 6 municipalities, all of which can mostly be

considered rural - with accommodations varying from mid-size hotels to small fisherman's shacks. Lofoten had a DEi of 4,74, which should be considered decent considering its geographical location. In fact, the individual accommodation DEi's from this area varied from 1,17 to 7,28, showing that some of the accommodations have indeed managed to utilize many of the possibilities that broadband can benefit. Still, these statistics show that Lofoten should work on developing and upgrading their broadband Internet use, has they have the same rural basis as the accommodations in Hardangerfjorden.

A full example of a DEi-scorecard, produced and developed by SNG, can be viewed in Appendix C.

7.2 An Independent Calculation

Since SNG's DEi-formula is a protected trade secret, an independent calculation of a broadband utilization was carried out in this project. Knowing that SNG's DEi score is mostly based on the utilization of Internet enabled applications, an interesting challenge would be to take their calculation one step further, and to include other aspects of broadband use.

Although the computation of SNG's DEi-score might be quite complex, the concept is quite simple. The calculation of both these broadband scores can be viewed at as a "Black Box" (see Figure 7.3).

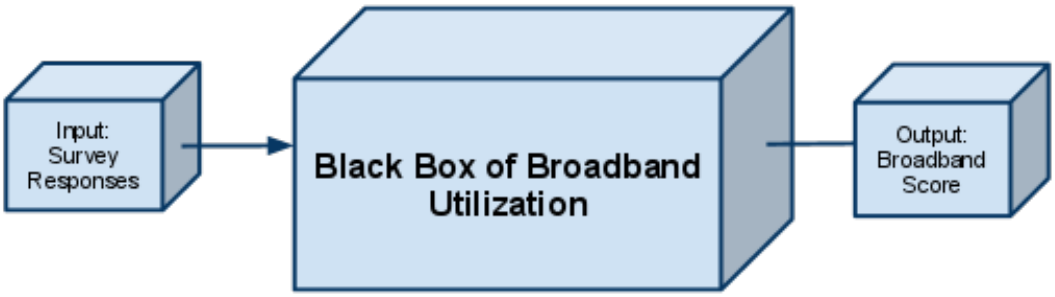


Figure 7.3: The Black Box represents the calculations that create a broadband utilization score [Stople, 2011].

In this black box, the survey responses from the e-Solutions Benchmarking Survey are entered as input. On the inside, scaling, prioritizing of values and calculations are performed, resulting in an output value in shape of a broadband utilization score. The following subsection will describe the composition of this new black box.

7.2.1 Composing the Black Box

Figure 7.4 shows the main setup around this new broadband utilization calculation. This is the "Black Box" that will perform the necessary calculations to generate an output "Broadband Utilization Score". The four elements that are emphasized are: Infrastructure, the use of ICT equipment, broadband readiness and the use of e-solutions.

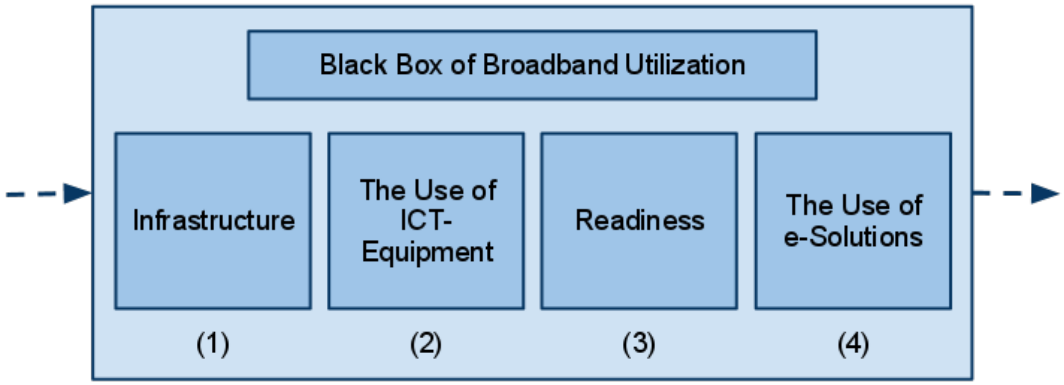


Figure 7.4: The underlying components of the independent utilization calculation [Stople, 2011].

Worth noticing, is the inclusion of three new categories as compared to SNG's DEi-method. Whereas SNG has focused on a number of different categories of e-solutions utilization, this formula also includes three new areas that should be considered important. Figure 7.4, discloses the black box of this independent calculation. In the following subsections, the reason for inclusion of each of these categories will be explained. To contribute this explanation, the reader is recommended to access Appendix B containing this independent calculation, named "the Stople-Index".

Infrastructure

The foundation of all broadband utilization needs to be the acquiring of an access technology. Therefore, Infrastructure (1) is introduced as the first of these new elements of attention. Without an access technology connection, there is no Internet, and without Internet there can logically be no use of its services either. The first criteria of this independent calculation is therefore to estimate a way to give the available access technologies different values - based on download- and upload speed as well as reliability.

As was brought up in the technology presentation in Chapter 2, there are many different methods of transferring information through a broadband network. The solutions may be both wired and wireless, and boast varying

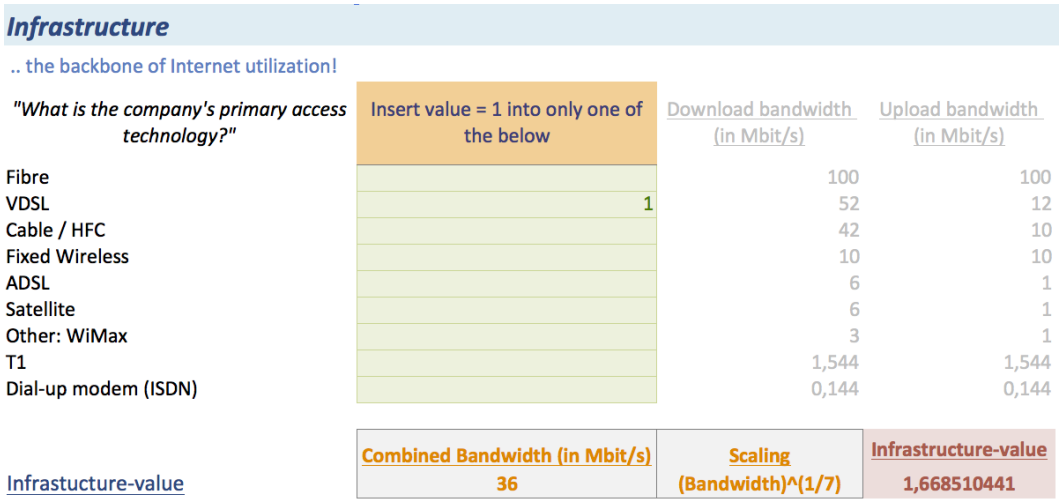
download- and upload bandwidths. In this formula, one type of main access technology, that is commonly used for companies today, is to be selected - in the bandwidth range of 0,144 Mbit/s (ISDN) to 100 Mbit/s (fibre). In real use, the actual bandwidth may vary from these predifined bandwidths. As the use of e-Solutions today are affected by bandwidth in both directions, they are both calculated to have an impact on the infrastructure-value. Still rated as more important for the use of Internet services, the available download speed is weighted heavier than the upload speed - with a 3/5 and 2/5 part share, respectively. Adding these values together, forming a combined bandwidth, will make asymmetric technologies take a drop in their total bandwidth-"value", while the symmetric technologies will remain unaffected.

Within each technology, factors such as technology improvement, cable length, infrastructure saturation and environmental conditions can have an impact on the available bandwidth. However, seeing that most of these indicators vary in time, or are determined locally, they are difficult to measure. Therefore, for the cause of simplicity, these factors are disregarded in this calculation. Being an "on demand service", like is the case with e.g. satellite and WiMax connections, does minimally reduce the total capacity, mostly to give the wired technologies a slight advantage with regards to availability.

The most important adjustment to the calculation of the infrastructure-value of this calculation is, however, the down-scaling of the access technologies. All the access technologies have been computed a lower value than their original, mixed bandwidth. By taking the 7th root of the combined bandwidth, the increase of bandwidth will have a logarithmic growth in the infrastructure value. The simple reason for doing this, is that many of the basic Internet services can be performed over low bandwidth, such as hosting a basic website, reading e-mails and accessing information online. Also, many e-solutions today can be performed rather flawlessly if equipped with a bandwidth of e.g. 10 Mbit/s, like is the case with fixed wireless. For this reason, it is important to give more credit for increasing the bandwidth from 0 to 10 Mbit/s, than to go from 10 to a 100 Mbit/s - although the latter will indeed receive a higher total score in this index.

The image above, shown in Figure 7.5, shows an image extract from the independent calculation program. As can be seen, there are several options of access technology to choose from, all with bandwidths pre-set based on the normal in the market. The column to the far right shows the combined bandwidth, with the upload- and download speed differently weighted.

Choosing VDSL as the company's main access technology will select a combined bandwidth of 36 Mbit/s. After taking the 7th root of this bandwidth, as part of the scaling process, it creates an infrastructure-value of 1,67. Putting this number into perspective, the infrastructure value of, for instance, fibre is 1,93 and ADSL is 1,22. This shows how the scaling works with thought to the logarithmic development that an increase of bandwidth is bound to have in



Infrastructure

.. the backbone of Internet utilization!

"What is the company's primary access technology?"	Insert value = 1 into only one of the below	Download bandwidth (in Mbit/s)	Upload bandwidth (in Mbit/s)
Fibre		100	100
VDSL	1	52	12
Cable / HFC		42	10
Fixed Wireless		10	10
ADSL		6	1
Satellite		6	1
Other: WiMax		3	1
T1		1,544	1,544
Dial-up modem (ISDN)		0,144	0,144

	Combined Bandwidth (in Mbit/s)	Scaling (Bandwidth)^(1/7)	Infrastructure-value
Infrastucture-value	36		1,668510441

Figure 7.5: Image extract from the Stople-Index calculation file: Choosing the access technology [Stople, 2011].

this case.

The final "Infrastructure-Value", that can be seen in the red box in the figure, is at this stage only a representative value for this category. This will also be the case for the remaining three categories, as the final Broadband Utilization score is computed as a thoroughly devised combination of the values generated in all four categories.

Use of ICT Equipment

After computing the importance value of the selected access technology, it has to be defined how one utilizes the connection - i.e. what kind of equipment that is used at the user-end. This is the second category in the black box-figure. The logic is simple: Even if equipped with the most expensive technology available on the market, providing the highest possible bandwidth out there, there is no way to utilize it without having a stationary computer or laptop to hook up to this connection. Therefore, it has to be specified if the company uses stationary, desktop computers at the workplace, if the company instead (or additionally) uses laptop computers, and if web-enabled devices are used as well as supplementation. This criteria also defines how *mobile* the company is. Mobility is, as mentioned in Section 2.3.3.3, an important factor for increasing a company's effectiveness. Figure 7.6 is an excerpt from the calculation program, showing the different choices a company has when stating the level of web-enabled devices it uses.

Closely related to mobility, and also a part of the ICT-equipment-value, is the aspect of offering teleworking to the company's employees. Although only having a small impact on the calculation, it is still included in this category because of its possible impact on employee effectiveness. By providing mobility

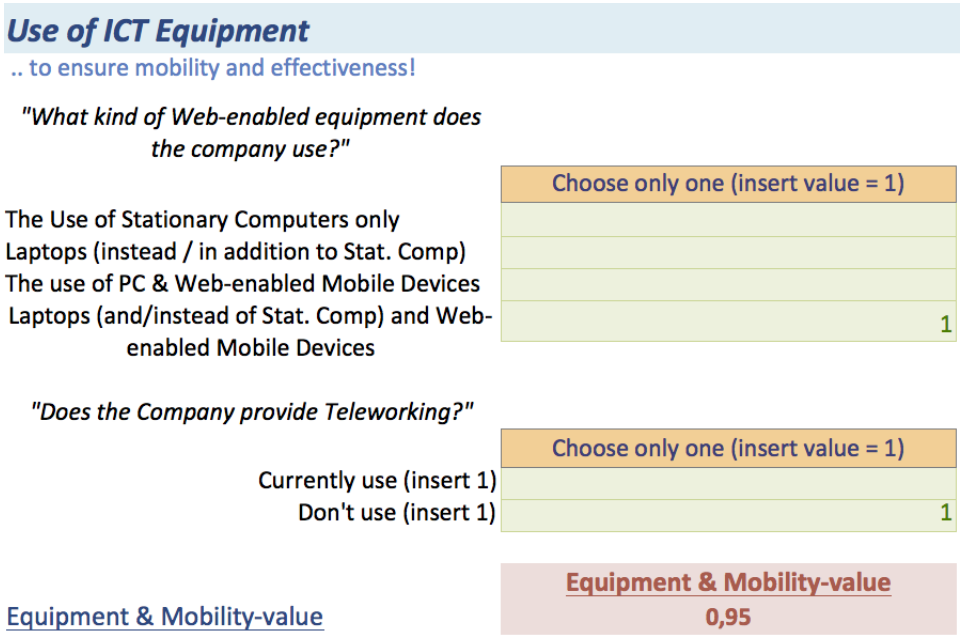


Figure 7.6: Image extract from the Stople-Index calculation file: Declaring equipment & mobility [Stople, 2011].

at the workplace, as well as the possibility of working from home, will therefore achieve a slightly higher score in this broadband utilization calculation than if it is not yet introduced.

Readiness

The third criteria is broadband readiness. The construction of a high-speed infrastructure, and the introduction of loads of ICT-equipment, is still not sufficient to make good use of broadband technologies. Many people with the possibility of using broadband simply lack the skills to take advantage of the technology, or they do not realize the benefits they could obtain if they started to use the Internet properly.

In this calculation, a lot of weight in the "Readiness"-category is put on the amount of time that the business has been provided with broadband Internet. The ability to adapt to broadband, for both individuals and companies, is very much based on the amount of time that they have had the connection. Having a broadband connection for less than a year, for instance, has to reflect that the short time in use naturally limits the amount of knowledge that can be obtained, as well as the number of solutions that can get implemented. The value of having broadband access over time deserves to increase somewhat logarithmically, as the increase in knowledge and possible implementations will diminish over time, after initially experiencing a rapid growth. This idea is reflected in the calculation, meaning that a company will receive a higher

score on this index when moving from one to two years of broadband use, than it will going from four years to five, for instance.

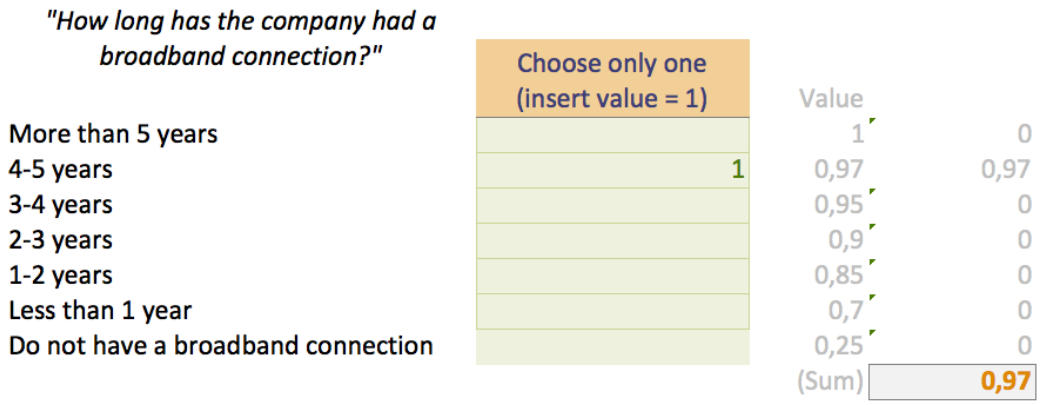


Figure 7.7: Image extract from the Stople-Index calculation file: Selecting the duration of having a broadband Internet connection - weigthing the values [Stople, 2011].

Figure 7.7 displays the periods of time that are options in this calculation, and the different values of the options can be seen in grey on the right-hand side. Reiterating what was just stated, one can notice the diminishing increase in value as the time of having a broadband connection installed, increases - where 1 is the highest achievable value. An option of not having a broadband connection is also included, and selecting this alternative will give a significantly lower readiness-score than the other alternatives. Still, the purpose of this broadband calculation is to find out how well a company utilizes the Internet and its services, and not having a broadband connection will without doubt prevent any effective utilization of the available e-Solutions. Not deserving of a disqualification, as some services can still be performed (albeit at very slow speeds), the score is deliberately tuned down a great deal.

As the Internet and the IT-industry are places of constant evolvement and innovation, it is important to regularly acquire the necessary skills and knowledge to be able to adapt to the new technologies. An important part of a company's business is to ensure that the employees receive staff training and skills development to operate in todays digital world, and is therefore included in the calculation in this category. By offering this, the company will receive a higher total output score. It is important that the employees know how to correctly operate the e-Solutions that have been implemented at the company, and although learning by oneself might very well work in a lot of cases, formal training or training sessions can increase the learning speed of the employees. Having an advanced IT-user at the workplace, who is part of the daily environment, can also act as an enabler for obtaining IT-skills.

The Use of e-Solutions

The use of e-solutions can be considered the most important category in this broadband calculation. A number of e-solutions, and their use and benefits, have been thoroughly explained and presented in Section 2.3 ("Economic Benefits of Broadband in the Society") and in Section 5.2 ("How do They Utilize the Internet?"), in Section 6.2 ("Describing the Selected e-Solutions").

Common for all of the e-solutions, is that they are intended to make the daily operations of a company easier and more efficient, to increase the social and economic benefits, and to bring new aspects into a company's business strategies. Some are easier to achieve than others and can be done with the knowledge of internal expertise, while other e-solutions requires outsourcing to be able to implement.

Like is the case with SNG's DEi-score calculation, this independent calculation relies on the use of a number of e-solutions utilization categories, and their values are differently weighted in accordance to their estimated positive impact on a company's utilization. The selection of e-solutions are split into two categories, entitled Group 1 and Group 2. Group 1 consists of the more basic e-solutions: the ones that are easier to implement and that meet many of the necessary needs for a company when attempting to utilize the Internet. Examples of these basic solutions are: setting up a company website, using the Internet for customer service, performing e-Banking and using social media networking in business marketing. When it comes the valuation of these categories, it is laid stress on that e.g. having a website is far more important for a business than using e-government to obtain information - thus handing "Host Company Website" a larger weight in the calculation.

Group 2 holds e-solutions that, once a company has established itself as a competent broadband user, can take its utilization one step further. Combining the e-solutions categories in this group, the score will have a lower impact on the total "Use of e-Solutions" score than Group 1, simply because these are more advanced services that a company may manage to carry on without. However, they are still important factors and will certainly bring extra benefits, and will contribute in giving the business an edge over its rivals.

When proposed the use of these e-solutions in the survey, the accommodation has to answer if a solution is currently in use, if it is planned to be used, if they have no plan to use it, or if they don't think its applicable for the business. For simplicity, and due to the fact that it the only option that actually uses the solution, "Currently Use" is the only choice that will have a positive impact on the e-solutions score. If the accommodation has answered "Plan to Use", it should rather be of interest to redo this broadband calculation after the planned changes are carried out.

This category, with the selection of e-solutions and their value-weightings, can be further examined in Appendix B.

7.2.2 Independent Calculation Output Score

The four categories that were described as parts of the Black Box of Broadband utilization, introduced earlier in this chapter, result in an output score that defines the current broadband utilization of a company. This score is called the "Stople-Index", and is constructed to help companies understand where they can improve their Internet utilization - in terms of the use of e-Solutions as well as underlying factors like infrastructure, equipment, mobility and readiness. Generating a score between 0 and 10, the concept of the Stople-Index is to easily bring feedback to companies and organizations based on answers that are provided, for instance in form of a survey. This is the same concept that SNG has developed in their DEi-calculations, and doesn't necessarily have the goal of increasing a company's output score. Instead , it is aimed to provide benchmarks and information to help guide the enterprises in their decision-making of how to make greater use of the Internet for their operational goals.

Achieving a score of 10 in this index indicates a perfect use of broadband Internet and e-solutions as the market is today. This includes the use of online services, as well as having access to the best access technologies and collecting the maximum score on the state of readiness. A lot of weight in this calculation has been but on the amount of bandwidth that is registered. The ability to be able to handle the challenging and constantly more demanding online services, needs to play an important part in a company's day-to-day business. If a company can only show off a T1 connection as its main access technology, the index score needs to reflect that, as many online services will have hindered effectiveness because of this bandwidth. The Stople-Index score is, as mentioned before, not constructed to only generate an output number and confirming usage solely on this score - but to also constructed to confirm and identify the possible improvements that can be made.

7.3 Comparing the Calculation Methods

To show how the Stople-Index calculation works in practice, survey results from anonymous accommodations will be entered as input in the "Black Box". Then, we will take a look at the output score that is generated, explain the value of the score, and compare it to SNG's generated DEi-score for the respective accommodations.

As already mentioned, this calculation places emphasis on four different categories: infrastructure, equipment & mobility, readiness and the use of e-solutions. For the sake of diversity, three accommodations were chosen - each utilizing different primary access technologies as well as having a somewhat different overall responses.

Table 7.1 displays the three hotels with their belonging generated utilization scores - both the DEi and the Stople-Index.

Table 7.1: Output-score for the two broadband utilization methods based on survey results from three anonymous accommodations

Accommodation	*DEi-Score (SNG)*	*Stople-Index*
Hotel A	8,83	5,59
Hotel B	5,34	5,50
Hotel C	7,28	4,53

At first glance, it seems that the Stople-Index produces an overall lower output-value. Looking at Hotel B, however, proves that this is not necessarily the case, as this accommodation in fact has a higher output value than with SNG's index. To better understand the Stople-Index output score for each of the three hotels, a closer examination of what has been calculated inside the "black box" needs to be undertaken. The input data for each of these accommodations can be viewed in Appendix B.

Hotel A

This accommodation scored a *5,59* on the Stople-Index, indicating that broadband services are indeed being used, albeit not at an optimal rate. Their primary access method is at the moment a fixed wireless connection, which can optimally achieve a symmetric bandwidth of 10 Mbit/s. Comparing this score to SNG's DEi-score, it is a bit lower than their *8,83*. The reason for the deviation between the two values lies in the additional categories that the Stople-Index calculation includes. Having a near perfect use of all the available e-solutions, with the only service not being used is the delivery of services and content online, the factors preventing them from scoring higher is first of all their access technology. Fixed wireless technology does provide a decent bandwidth, but it is still some way off the best technologies in the market today. It may be sufficient to carry out many of the basic, as well as advanced tasks that are available today, but increasing the bandwidth will without doubt lead to faster utilization and lead to savings in both time and costs. As an example, if Hotel A upgrades its broadband technology to fibre-optic cables, an output score of *7,83* would be generated, reflecting the importance of having a strong broadband connection.

Another factor that plays a part in deducting "broadband-points" from this hotel, is the duration of time they have had broadband Internet. Recalling the

readiness-category, that was explained in Section 7.2.1 when describing the Black Box, only having had a broadband connection for 1-2 years prevents this hotel from scoring higher in this index. Illustrating what the output-score would be once this company has had Internet for more then 5 years, and thereby have had the time to grow accustomed to the solutions and managed to integrate them as a common part of everyday operations, the index would rise to *6,58*. Combining these two "changes" would in fact elevate the score to as much as *9,21*, underlining the significance of the "Infrastructure" and "Readiness" categories if one is to achieve a high score in this index.

Hotel B

Hotel B has a more advantageous starting point than Hotel A, as it is already using a fibre-optic connection. Other than that, as can bee seen in Appendix B, it utilizes a much narrower range of e-solutions than the first hotel, and does neither provide teleworking nor training and skills-development for its employees. These factors will, naturally, pull down Hotel B's overall broadband utilization score a fair amount.

In an attempt to better their score, this hotel should consider introducing web-enabled mobile devices in its daily operations. As of today, they only use laptops to access the Internet while at work. Mobility is, as mentioned several times before, an important factor for increasing a company's effectiveness. Adding web-enabled mobile devices to their daily operations, would increase their Stople-Index score to *6,12*. Bridging the teleworking-gap, that is introducing the opportunity for employees to work at home as well, would bring this adjusted score up to *6,44*.

The remaining gap up to a perfect score of 10, would imply that the accommodation would have to implement and introduce more e-solutions into its operations than is done today. It has the necessary infrastructure in place, but may not be aware of the benefits that its broadband connection can provide. The broadband utilization score of *5,5* shows this, confirming that there are certainly improvements that could be made in this accommodation's broadband utilization.

Hotel C

This last accommodation scores, like Hotel A, has a somewhat lower score on the Stople-Index than on SNG's DEi, and once again this variation can be explained by the choice of infrastructure. Hotel C has a ADSL connection, only providing the accommodation with 6 Mbit/s downstream and 1 Mbit/s upstream to transfer information over the Internet. This means that this connection is best adapted for services like information research, e-government and after-sale services. These tasks is manageable with the 6 Mbit/s down-

stream as the hotel is mainly the the receiver of data. When it comes to more advanced, two-way uses of the Internet, like database sharing and video-conferencing, the 1 Mbit/s upstream bandwidth is not sufficient for an optimal experience of these services.

Still, this hotel is currently using 11 out of the 14 e-solutions that have been categorized in this calculation - and has registered that it has future plans of implementing the remaining 3 categories in the near future. Once it has introduced online advertisement and promotion, customer service and the ability to deliver services and content online (the solutions it is missing), this accommodation will reach a broadband utilization score of *6,31* on the Stople-Index.

As pointed out, the main barrier to improve the broadband utilization for Hotel C lies in its broadband infrastructure. In fact, the ADSL connection acts as a bottleneck, preventing the optimal use of the services the accommodation is either already using, or planning to use. Imagining that the hotel completes its investment in regards to implementing the remaining e-solutions, and also upgrades its broadband access type to, say VDLS, it will achieve an impressive score of *8,64*. If it instead chooses to upgrade to a complete fibre-optic network, it will literally ace the Stople-Index - achieving the maximum score of 10.0.

7.4 Reviewing the Independent Calculation

In the calculation-examples given above, an attempt has been made to explain the output-scores of the independent calculation presented in this chapter. By changing some of the input values, it has also been shown what kind of impact small changes can have on the outcome - an important factor when trying to identify potential gaps and needs when analyzing such results.

Remembering the calculation of the scores of the three anonymous hotels above, it is clear that certain weight has been put on all 4 categories of this broadband utilization calculation. These factors are all dependent of each other, and therefore, scoring low in one of these categories will not make it possible to achieve the highest output score.

Inside each of the four categories, thorough estimations have been placed on the weighting of different services and solutions. The chosen values are based on personal calculations and intuition - attempting to make the combinations and outcomes of the calculations as logical as possible. It will always be the case that a model like this can be adjusted and improved almost indefinitely, as a optimal "solution" for these kind of calculations have to be based on experience obtained over time.

A suggestion to an extension of the Stople-Index, to compare a company's Stople-Index score, to other organizations in the same industrial sector - which is what SNG has done with their DEi-score. This is a great way to understand "how good" a score really is. However, as pointed out before, the Stople-Index

investigates many areas of broadband utilization, and one score might not be a lot worse or better than the other, even if the scores are fairly different. It should rather be considered as a method of realizing that they are missing something in their current utilization - hopefully leading them to find ways of improvement. By diving into the calculation-system, gaps and possibilities in their use can easily be identified, and simulation can be performed to find out where the opportunities for improvements can be found.

A second suggestion could be to add more complexity to the calculations. As this project has been carried with a limited duration, the time that can be spent tweaking on a calculation is restricted. An idea for making this model more advanced, would be to make the independent values more dependent on each other - as opposed to the individual calculation of each of the 4 categories as is the case today. To correctly implement such changes will, however, be quite time consuming - at least if one is to ensure the outcome of logical scores.

Chapter 8

Conclusion

The Internet is far from being a static or mature technology, as it is still rapidly evolving. Since the spread of broadband technology, traditional Internet activities, like information research and after-sale services, have intensified. In addition, many new kinds of content-rich broadband Internet applications continue to emerge, like online transactions, multimedia streaming, VoIP technology and social media networking. On the horizon are even higher data-intensive applications - such as high-definition streaming of video and TV, new peer-to-peer applications, virtual conferencing and health- and educational applications.

As consumers today are constantly demanding more advanced content, both faster downstream- and upstream bandwidths are essential for the further development of our information society. Norway has in recent years, as one of the pioneer countries in the OECD, focused on this area by constantly improving itself and trying to be innovative on the area of bandwidth capacity, electronic business, digital delivery and in the use of other broadband applications.

In this research project, many aspects of broadband utilization in the accommodations sector, in both Norway and in the US, have been reviewed. Common for both countries, is an underlying drive for constant broadband evolvement. The difference, however, seems to be that Norway, on average, is further along the path to a fully upgraded broadband society. This is based on both statistics from the OECD and the analyzed results in this survey. A large number of results in the American sector still utilize well-aged access technologies like T1 and dial-up, implying that there are a lot of e-solutions and broadband opportunities these enterprises are missing out on. There is of course the possibility that they might feel they have enough bandwidth to "get around", but it is not to be suppressed that they are missing out on many social and economic benefits that would improve their daily operations - maybe even turning out to be vital in future competition among rival enterprises.

It is important to mention that the use of advanced e-solutions is still in

its infancy, like is the case with e-health, e-government (for instance the Norwegian e-voting system) and teleworking. The use of web-enabled applications has exploded over the last few years, especially in regards to web-enabled mobile phones. In Norway today, more often than not, people have phones they can use when wanting to access high-speed Internet in search for information. As mentioned in this report, Norway is, as of 2010, one of the most advanced countries in the world in regards to Internet connectivity, both wired and wireless. The late introduction of the LTE technology will only improve the Norwegian broadband market, adding a new dimension of mobility when enjoying the benefits broadband can offer.

For the reasons just mentioned, it may not be that enterprises don't wish to achieve these broadband utilization benefits. They should neither be blamed for assuming that certain applications don't apply to their business. The fact is, that companies and organizations might not possess the required competence or knowledge to effectively make use of broadband in every possible way. This may especially be the case for small business firms. It can be described as simple as: "you don't know what you don't know". In these cases, bringing in external resources to spread awareness and experience may be the solution.

These external resources can turn out to be a major catalyst for businesses' awareness in regards to the opportunities that lies in broadband utilization. Broadband specialist companies, like Strategic Networks Group, may be what is needed to realize that both social- and economic benefits can be achieved if the correct investments are made in both broadband technology and e-solutions. Companies in competitive markets today are mostly driven by trying to do what others are already doing - that is, trying to copy the success of other enterprises when the benefits are obvious. Broadband is proven to bring such benefits to individuals, businesses and organizations as well as to societies as a whole. Thus, there is no reason for businesses today to sit on the fence and wait for their competitors to try out these new technologies, just because they are satisfied with the current state of things.

The importance of utilizing the available broadband capacity in the best possible way, is in any case the underlying issue. SNG has stated that: "Broadband today is as vital as electrification was in the 1930's". This may very well be the the case, as the constant emergence of new, innovative applications seek to make our society more efficient and our lives easier. It is only a question of bridging possible barriers, to identify these opportunities when they arise, and being able to utilize them properly.

Chapter 9

Future Work

The first suggestion for future work, is to *perform a new and wider survey*. Even though the response rate achieved in this project was very respectable, it could still be of great interest to repeat the survey in an attempt to collect more responses from the already selected geographical areas. As the hotel- and accommodation-sector is a quite busy one indeed, many of the enterprises that were enquired informed that they were pressed for time during the period that the online survey was active, but that they would like to participate should the opportunity arise at a later point in time. The inclusion of more accommodations in the database would provide a greater foundation and a more accurate representation of the selected sector in regards to broadband utilization.

Another interesting aspect would be to *analyze potential economical benefits*, based on the survey responses the accommodations provided in this project. Too few accommodations were willing to state economical data in the survey. Therefore, analyzing this data would most likely lead to inaccurate results from the surveyed regions. This could, however, be carried out if given a larger database of surveyed answers, like was suggested above. It would be interesting to see if they survey population has experienced an increase in revenue as a direct result of broadband investment, or if they are still waiting to reap the benefits from the services they have invested in. What could also be analyzed, is broadband's impact in creating new jobs - or if it responsible for the reduction of already existing ones.

A follow-up process was carried out in this project, providing two selected hotels with feedback on how to improve their use of e-solutions in order to better their utilization of broadband Internet. It would be very interesting to *contact these hotels*, at a later point in time, to *see if any of the proposed changes and introductions have been carried out*. A great idea for further research would be to see how they have adapted to these changes and if they, as a result, are experiencing any social or economical benefits.

Relations between relevant business models and the results of this research

study is also an aspect that could be looked more into. An example can be to try to identify if there are any relevant business models that can help *preventing rebound effects* that broadband efficiency and potential cost reductions may lead to.

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Appendices

Appendix A

Access Technology in General

A broadband network has different methods for transferring information through its final segment, the part between a unit placed at the customers and at the operators' closest node. Both these components contain senders as well as receivers, and different technologies can be used to send information between them. Threads of copper, coax or fibre are used for the cable-based technologies, while radio-waves sent through the air are used for wireless solutions.

Common for all data-transfer technologies is that there exists physical limitations when it comes to how much data that can be transmitted. The size of the frequency spectrum, *the bandwidth*, decides the amount of information that can be transferred through a medium in a given space of time - setting *the capacity*. Other important aspects that can influence the bandwidth are: *the distance* between the sender and receiver, *the noise* on the transmitting channel, and (for wireless technologies) *the number of simultaneous users* utilizing the network capacity.

We can divide broadband access technologies into two categories: Wired- and wireless access. Although developed to serve the same purpose, they each have their advantages and limitations, and will be reviewed in the following subsections:

A.1 Wired Access Technologies

As the technical evolution in the world of telecommunications has rapidly put on speed in recent years, many wired access technologies have begun entering the common market. This section will give a short overview of the most common wired technologies as of today.

A.1.1 ADSL

Asymmetric Digital Subscriber Line (ADSL) is the most commonly installed technical variety of the DSL-family - a family of technologies that all enable

access to the Internet via the existing copper infrastructure of the ordinary telephone network. ADSL is offered side by side with regular telephone service on the same telephone line, which is possible because ADSL uses a higher frequency. The networks' lower frequencies are utilized by analog telephony or ISDN, while the higher frequencies are used for both upstream- and downstream data transmission.

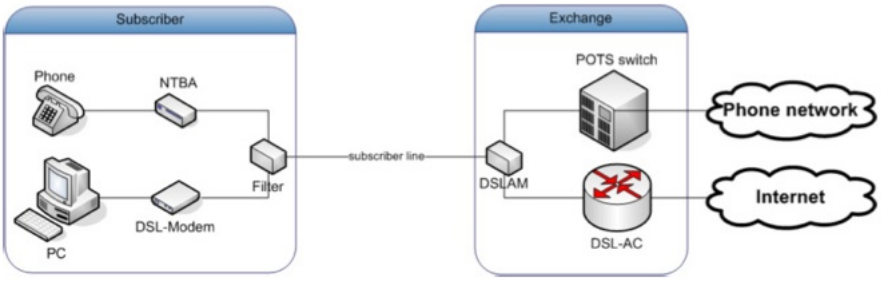


Figure A.1: DSL (Digital Subscriber Line) principle [7].

In the above figure, Figure A.1 we see that, by splitting the line at the subscriber and using a filter at the Exchange, both Broadband data transmissions and telephone services over the same subscriber line.

Being an asynchronous technology, with a capacity of 6 Mbit/s downstream and 1 Mbit/s upstream, ADSL is best adapted for services such as information research, e-government and after-sale services. In these tasks, the user is mainly the receiver of the data. When it comes to more advanced, to-way use of the Internet, like database sharing and video-conferencing, the capacity of ADSL might not be sufficient for an optimal experience of these services.

Figure A.2 shows the principle of the Asymmetric Digital Subscriber Line.

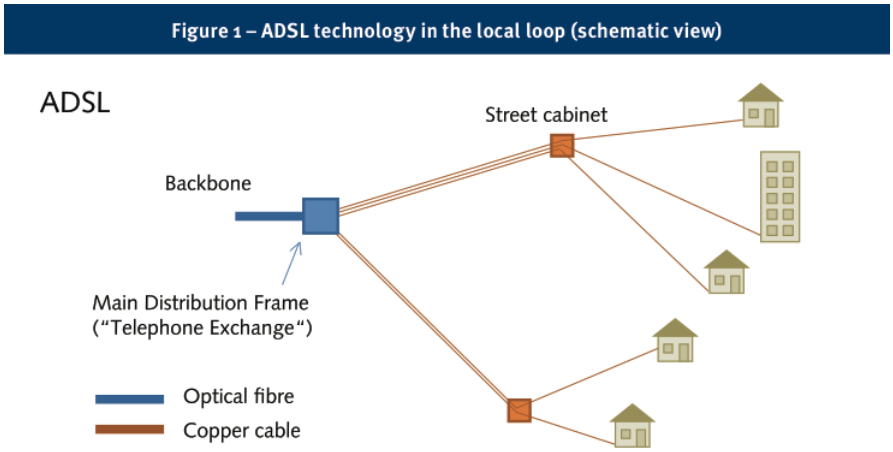


Figure A.2: ADSL (Asymmetric Digital Subscriber Line) technology in the local loop [Com11].

In Norway, ADSL was the first DSL technology to be set up, and it is still very widespread. As the bandwidth of ADSL diminishes sharply when the length of the copper link increases, the maximal line-length using this technology is 5.5 km. Because of this, ADSL technologies have limited reach in rural areas.

As an evolvement of ADSL, **ADSL2+** can offer an increase in data transmission capacity by utilizing higher frequencies in the telephone network. ADSL2+ can offer capacities of 20 Mbit/s down- and 1,2 Mbit/s upstreams. Despite of this improvement of the ADSL technology, the available bandwidth is considered too slow for multimedia applications such as video-conferencing and HDTV.

A.1.2 VDSL

Very-high-bitrate DSL (VDSL) is the most advanced DSL technology to date, and differs from ADSL by that the telephone companies replace their main feed in the local loop with a fibre-optic cable. By doing this, VDSL services can reach transmission speeds of 52 Mbp/s downstream and 12 Mbp/s upstream depending on the length of the copper link in the street cabinets to the homes. This upstream speed is around 14 times faster than the maximum speeds that can be aquired with todays ADSL broadband. To achieve close to full effect, the length of these links should not exceed 300 m [5].

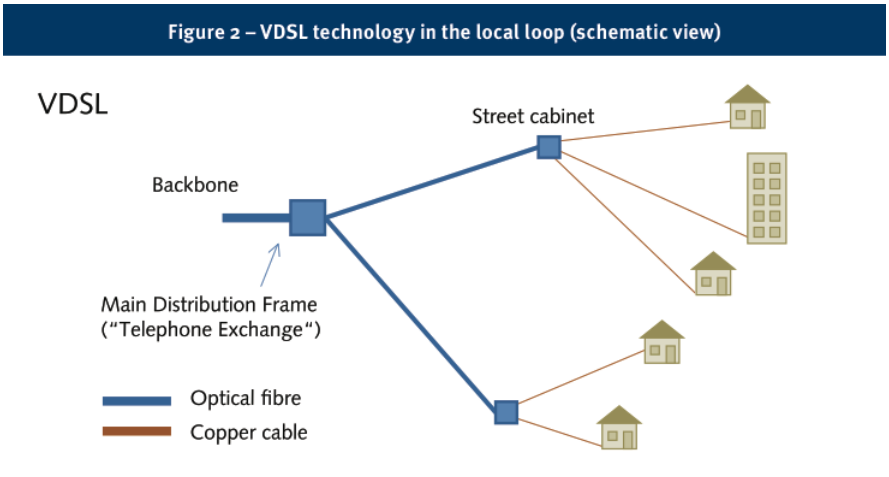


Figure A.3: VDSL (Very-high-bitrate DSL) technology in the local loop [Com11].

As can be seen in the above figure, Figure A.3, fibre-optic cables are deployed between the main distribution frame (MDF) and the street cabinets, while copper cable is used to connect the street cabinets to the homes.

Deploying the VDSL technology from scratch is expensive, as the telephone companies have to undertake the upgrade costs that are necessary for their backbone cables from copper to fiber-optic. This is, however, a cheaper option

than deploying a complete fibre-optic solution (by also upgrading from the street cabinet to the home), as telephone companies won't have to change out the end-connections. Already having the ducts containing copper cables, they can make the transition easier by using these to transport the fibre-optic cables as well.

On February 1st 2011, Telenor started to launch its VDSL upgrade in Norway, hooking almost 1.000.000 customers on to this "super-broadband" - with the vision of serving 30-40% of all Norwegian households with this technology, as well as 40% of the business market, by the end of the year [8]. This broadband upgrade is good news for the Norwegian business market, as it introduces the possibilities of performing video-conferencing and making large downloads. The new and improved upload-speeds are very attractive for businesses that send heavy e-mail, and also for those who offer their customers Internet-based services from their servers.

A.1.3 Fibre-Optic Access Networks

Of all the wired technologies presented in this chapter, the use of fibre-optic cables looks to be the most future-proof one. By sending impulses of light through cables of optical fibre, this technology can transfer information from one place to another at speeds up to several Tbit/s (1'000'000 x 1 Mbit/s) - depending on the technology being used at the connection point between two fibres [Com11]. When the length of the fibre-optic cable increases, the loss the data transmission capacity can be considered close to neglectable, making this technology very suitable for telecommunications networks in rural areas or intercontinental communications.

Although the idea of using fibre-optics in telecommunications was considered as early as in 1966, it was only in the 1990's that the demand for these cables, that could carry heavy loads of data, became significant. Many countries' telephone infrastructures were starting the upgrade to use digital, optical technology instead of the traditional copper networks as their backbone technology to connect to the local telephone exchanges. Today, with optical fibres serving as the foundation, only the very ends of our telecommunications network is served by other technologies - like copper wire, cell phones or cable.

An important advantage that comes with the use of fiber optic cable, is its scalability. Fiber optic cables have no limitations as an information transport medium, with its performance only restricted by the electronic components surrounding the cables. In other words, the scalability is dependent on the upgrade of electrical senders and receivers at the end-points.

Fiber-To-The-Home (FTTH) is an expression for the network architecture where fibre is used as an access medium all the way to the customers at the end-points. As briefly mentioned in the paragraph above, some installations may use the existing twisted pair- or coaxial copper network, Wi-fi or power-

line the last meters when connecting to the end-user. This technology is called Fiber-To-The-Building (FTTB) and is usually used in multi-storey buildings. From here on we will not distinguish between FTTH and FTTB.

Over the last couple of years, FTTH has deployed greatly in Norway. As of late 2010, the number of FTTH subscribers approached 200,000 - a number that will continue to grow in 2011 [oT11].

The figure below, Figure A.4, displays an overview of an access network based on the FTTH and FTTB-technologies.

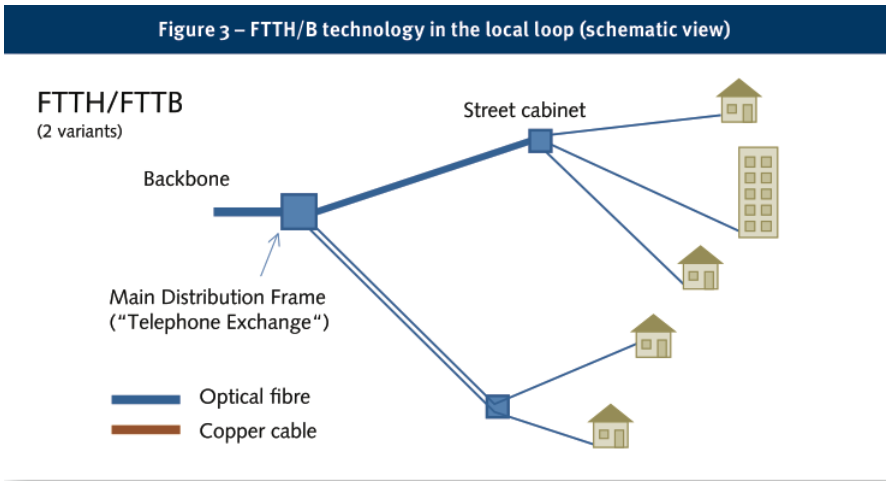


Figure A.4: An overview of FTTH and FTTB technology in the local loop [Com11].

Figure A.4 shows the two basic architectures that are used in the deployment of fibre optic cables: Passive optical networks (point-to-multipoint) and Active optical networks (point-to-point).

Active optical networks

Active optical networks has been chosen by most fibre-network distributors in Norway, with Telenor being the exception. We can see the AON solution sketched in the lower part of the figure above, where each customer receives a dedicated fibre all the way from the telephone exchange - hereby the description point-to-point. This cable is not shared with their neighbors, and offers as much as 100 Mbit/s in both directions.

Passive optical networks

The top part of the figure shows a "point-to-multipoint" infrastructure, which means that several households share access to one fiber that is split when it reaches the street cabinet. GPON (Gigabit Passive Optical Network) is the most used solution today, and offers a total down- and upstream of 2.5

Gbit/s and 1.25 Gbit/s according to Telenor [oT10]. As many as 64 end-users can share one such fibre cable. Being the only network distributor in Norway that has chosen this architecture in the deployment of the fibre-optic technology, Telenor claimed that an important factor for their decision was that a PON-solution has less working expenses than an AON-solution. Active components can easier be centralized than what is possible in point-to-point network, making it easier to perform repairs and upgrades.

A.1.4 Cable / HFC

A Hybrid Fiber Coaxial (HFC) network is a cable network that utilizes a combination of both fibre optic and coaxial cable in different parts of a network to be able to transfer the data content. Fibre cables are used in the core of the networks, while the existing cable network is put to use the remainder of the way to the customer.

Having been deployed in European countries since the 1980's, the cable TV infrastructure is physically superior to the telephone infrastructure - as it was originally designed to carry out large quantities of information. Adding fibre-technology to this infrastructure gave HFC-operators the possibility to bring fibre cable (high bandwidth and low noise- and interference susceptibility) close to the end-users, as well as saving the costs of replacing the coax cable that is installed all the way to the walls of the homes and businesses.

The technology to be able to deliver broadband via this coax-fibre infrastructure is called Data Over Cable Service Interface Specification (DOCSIS). Theoretically, the coax cable has a data transfer capacity of 5.9 Gbp/s with today's technology. In combination with fibre, which we know from Section A.1.3 has close to unlimited capacity, this technology opens the door to many potential high-speed services - like Digital-TV/HDTV and Video-on-demand/HD [4]. In Norway the latest version of this technology is DOCSIS 3.0.

A.2 Wireless Access Technologies

Originally designed to transfer voice, the development of mobile technologies have now made them suitable to transfer data as well. Today, the bandwidth that can be provided by current mobile technologies is still lower than what can be offered by the best wired technologies. In addition, mobile technologies share the use of available bandwidth within a particular cell, making the available bandwidth dependent of the number of users.

Over time, there are two wireless access technologies that are known to have been dueling in the mobile market:

- The GSM-standard and its evolved technologies (EDGE, UMTS, HSPA,

LTE). These are all standardized by 3GPP [1]

- The CDMA2000 [2] and all the technologies evolving from it (EV-DO, UMB) standardized by the organization 3GPP2.

The GSM standard is currently the dominating technology of these two, as it of December 2010 had close to 90% (see Figure A.5) of the market on a worldwide basis [33]. Because of this domination, the wireless technologies discussed in the following subsections will consist mostly of those from the GSM-standard.

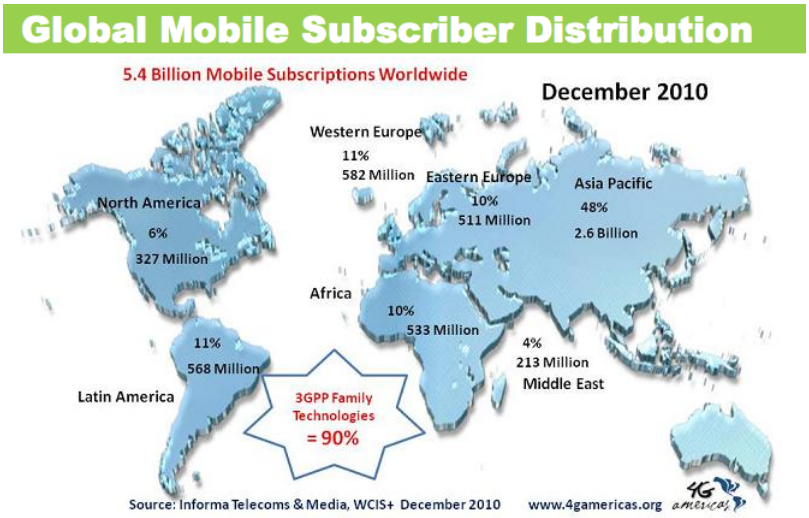


Figure A.5: Global Mobile Subscriber Distribution as of December 2010 [1].

GSM's domination is expected to carry on - probably even taking up more market shares - in the years to come. According to 4G Americas, by 2015, UMTS/HSPA and LTE 3G technologies are expected to account for almost 90 % of the global 3G subscriptions (with almost 3.9 billion subscriptions compared to 569 million CDMA- and 59 million WiMAX subscriptions [1]. The technologies will be further discussed in the following subchapters. Figure A.6 shows a chart containing the global subscription distribution between these technologies, as is predicted in the year 2015.

Figure A.7 displays an overview of the most common wireless access methods that are currently in use, and most of them are described with the maximal capacity that can theoretically be offered. The following subchapters will give a short review on most of these technologies and describe their specifications, range of use and their assumed potential.

[1]The 3rd Generation Partnership Project (3GPP) is a standards organization that is responsible for the evolutionary planning of the 3GPP family of technologies.

[2]CDMA2000 is a family of 3G mobile technology standards, which use CDMA channel access - to send voice, data, as well as signaling data between mobile phones and cell sites.

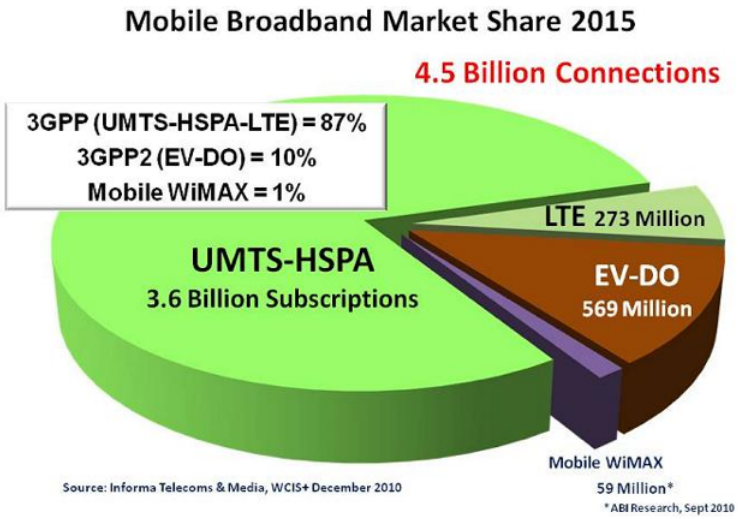


Figure A.6: Global Mobile Broadband Forecast - 2015 [1].

A.2.1 GSM / UMTS / HSPA

Standard digital GSM based mobile phone services of the 2G era offer voice and low data rates. By using a combination of TDMA[3] and FDMA[4], the GSM network can enable bandwidth access data transfer rates of up to 14.4 kbps/s.

The next generation GSM network is called the Universal Mobile Telecommunications Services (UMTS) network - also known as the 3G-network. In Europe, these two GSM technologies utilize the following frequency bands:

- *GSM*: Occupies the 900- and 1800 MHz bands. In Norway, the 900 MHz is fully occupied by existing operators, while the 1800 MHz band still has free resources.
- *UMTS / HSPA*: Occupies the 2,1 GHz band. The Norwegian operators Telenor, NetCom, HI3G and Mobile Norway each have a 3G-license in this spectrum.

As 3G is taking over for the standard GSM network, the frequency bands that are used for GSM will get reallocated in order to get used by UMTS and the imminent LTE network. In Norway, there are currently negotiations being held between Norwegian telecommunication operators regarding the allocation of the 900 MHz band, with a view of this to be used by UMTS as well [Nex10b].

Taking the evolution one step further, both NetCom and Telenor have upgraded their UMTS networks to HSPA (High Speed Packet Access), while a third operator, Hi3G Access Norway, is currently deploying its network (as of May 2011) [1]. 3G HSPA provides a number of benefits in this new service

[3]Time Division Multiple Access -
[4]Frequency Division Multiple Access -

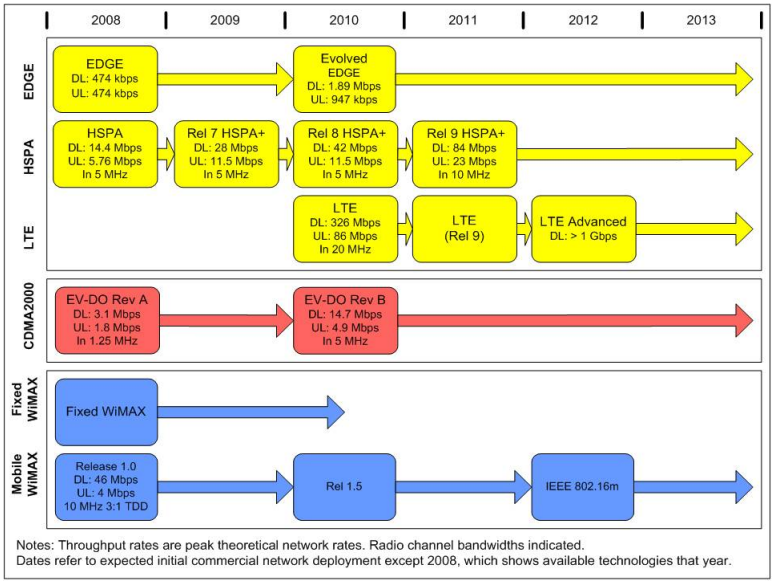


Figure A.7: Technology families for mobile broadband [1].

- such as increased data transfer rates, shorter transmission time intervals, the use of shared channel transmission and the use of link adaption [25] - all to provide a far better performance for the user. In theory, HSPA can offer the customer data rates of 14.4 Mbp/s downstream. Upstream, however, the current versions that are deployed in Norway cannot offer higher data rates than 7.2 Mbit/s.

Common for all mobile broadband technologies is that the available bandwidth will depend on the number of simultaneous users of the network, as the radio spectrum in use is shared between all customers that request access to it. Distance between the user and the base station does also play an important factor.

For the UMTS and HSPA technologies, the user bandwidth experience will be:

- UMTS: 70 - 130 kbit/s both down- and upstream.
- HSPA: 1 - 4 Mbit/s downstream and 0,5 - 2 Mbit/s upstream.

HSPA+ was deployed in Norway by NetCom/Telia Sonera in December 2010, and is also currently underway by Telenor [1]. HSPA+ (High Speed Packet Access Plus), also known as HSPA Evolution or Evolved HSPA, applies some of the techniques that have been developed for the Long Term Evolution (LTE) network - resulting in potential data transfer capacities of up to 21 Mbp/s. This upgrade allows operators to extend the life of their HSPA networks before fully committing to the upcoming 4G LTE & WiMAX networks.

A.2.2 LTE

As customers today wish to be able to access more information, such as business- and consumer applications, as well as entertainment through their mobile devices, the need for a constant evolution of the wireless broadband technology is necessary. Wireless network carriers are therefore currently working on implementing the next generation mobile network - Long Term Evolution (LTE) - to keep up with the customers' increasing expectations for bandwidth, speed and global access.

Both 3GGP and 3GGP2 are working together to lay the foundation of LTE [Wir11].

LTE is a 4G technology, and has a theoretical capacity of over 160 Mbit/s downstream and 50 Mbit/s upstream[9]. This is much higher than what is available in todays 3G network. As with 3G, the experienced bandwidth in LTE depends on factors like available frequencies, the number of simultaneous users and local conditions.

Being based on TCP/IP, the core protocol of the Internet, LTE based networks can deliver higher-level services - such as business applications, video and multimedia - while supporting the devices and applications of the future. When properly introduced into the market, it should be expected that many mobile devices will get LTE built into their system, leading the end-user to be able to achieve high-speed mobile broadband from almost anywhere.

In the Norwegian market, NetCom / Telia Sonera put the LTE service in service in December 2009, while Telenor are currently undergoing a trial stage with their LTE network [2]. In 2011, both Netcom / Telia Sonera and Telenor have announced that they are working on replacing their entire mobile network with the view of offering Norway's fastest mobile broadband [32] [24]. This means that they are going to switch out basic equipment at all their base stations, and upgrading them with fibre-technology - all this to construct a network that can simultaneously handle both GSM, 3G and 4G. By the end of 2012, they hope that 95% of the population will have access to 3G, and that 89% of the population will have access to 4G (LTE).

A.2.3 WiMAX

The 4G technology Wireless Interoperability for Microwave Access (WiMAX) is a range of technologies allowing data transfers over a radio link with a bandwidth of more than 50 Mbit/s over 20 to 100 km. This wireless system is commercially available both for fixed and mobile broadband, but the two systems aren't compatible and utilize partially different frequency spectra.

Fixed WiMAX (802.16d) has currently a moderate deployment in Norway, and is primarily used in areas that have previously been without broadband coverage. The technology works in the same way as fixed wireless access, which will be described in Section A.2.5, now utilizing 4G instead of 3G. For end-

users situated close to the base station, a symmetric bandwidth of 11,3 Mbp/s can be achieved. Telenor and NextGenTel are the carriers of WiMAX-services in Norway, offering speeds of up to 3 Mbp/s down- and 1 Mbp/s upstream.

The future of WiMAX is very uncertain, as a lot of work is currently being put into LTE and LTE Advanced - making this the most likely option for near to all 4G carriers in the future.

A.2.4 Broadband via Satellite

Satellite Internet provides 100 % broadband coverage in Europe, and can offer a bandwidth equivalent to ADSL access [Com11]. The importance of having this technology available is still truly genuine, as it may be the only alternative other than cellular broadband to connect people in rural areas where no infrastructure is available.

This broadband access method has a fairly high response time, due to satellite transmission, which prevents the efficient use of real-time technologies - like VoIP and videoconferencing. It has also, until recently, been one of the more expensive methods of gaining broadband Internet access. Therefore, it has mostly been used for professional use - for instance to connect Internet off-shore oil platforms or logistic facilities. However, recent improvements in satellite telecommunications technologies now allow satellite connections tho be offered to individual users, at affordable prices[Com11].

A.2.5 Fixed Wireless Access

This technology is included as a wireless broadband technology, despite that it does not necessarily support mobility. It is a type of high-speed Internet access where the connections to service providers use terrestrial radio systems rather than cables. This is a great way for areas that lack fibre-optic, DSL or television cable-connections to be able to enjoy broadband Internet access. It can easily overcome geographical obstacles and still deliver proficient broadband service, making it a welcoming option for many rural areas both in Norway as well as the rest of the world. Although they tend to offer lower data transfer speeds that are available via wired connections, fixed wireless services can support network bandwidth up to 10 Mbp/s.

In urban areas, Public Wireless LAN (PWLAN or Wi-fi hotspots) can be used to offer radio-based data transmission up to a range of around 100 meters.

For larger distances, the Internet providers maintain transmission towers, also called ground stations, that communicate with each other as well as the subscriber. For the subscribers to be able to connect with the ground station, and make use of the fixed wireless broadband network, they have to install transceiver equipment on their building or property.

This service can sometimes be unstable, as the quality of service can be

adversely affected by rain or fog. The technology also requires a line of sight between ground stations and the subscribers, and does neither support roaming.

Appendix B

Contents of Attached Zip-File

1 Copy of this Master's Thesis

2 Files Related to the Independent Broadband Utilization Calculation Index (The Stople-Index)

- *The Stople-Index Calculation:* Excel file containing the estimations and calculations so as to generate the Stople-Index output score, presented in Chapter 7.
- *Input File for the Stople-Index Calculations:* Input data from three anonymous hotels, used to generate the output score that is analyzed and discussed in Chapter 7.

3 References

4 Invitations to the Hotels in the Follow-Up Process (pdf)

5 List of Participating Accommodations

APPENDIX B. CONTENTS OF ATTACHED ZIP-FILE

Appendix C

SNG's DEi Scorecard

strategic networks group
the broadband economists

DEi Digital Economy Index Scorecard

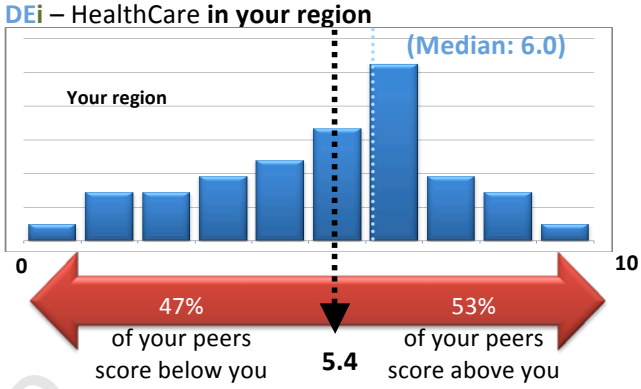
SNG's Digital Economy Index (DEi) is a composite score of how organizations use Internet-enabled applications, or "e-solutions", to drive efficiencies, innovation, and profitability.

Your DEi score (from 0 to 10) shows your utilization of e-solutions. Your score is based on your current utilization of e-solutions, with a ranking that compares you to businesses both in your area and your industry.

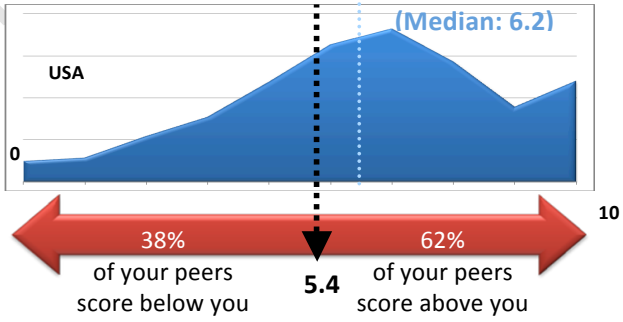
Acme Medicals, Inc.
Geldsboro, North Carolina

Your score: 5.4

DEi – HealthCare **in your region**



DEi – HealthCare **in the US**



Opportunities to improve your score

Increasing use of e-solutions will enhance your DEi ranking. More important than a score, you will be improving your bottom-line.

Below are the top three e-solutions opportunities we have identified which **Acme Medicals, Inc**. should be using based on the impact each would have on cost savings, or new revenues – a full list of opportunities is available in a customized report.

e-solution	*Net impact*
VoIP (Internet telephony): significant cost savings over traditional telephone providers.	**$12,000/year cost savings (increases DEi by 0.9)**
e-commerce: online sales of your products.	**$22,000/year new revenue (increases DEi by 1.0)**
Videoconferencing: eliminate the inefficiencies and costs of business travel.	**$9,000/year cost savings (increases DEi by 0.6)**
Net impacts driven by e-solutions	**$43,000 per year**

Getting started

To get started now, please contact Carol Torian, your business advisor with our partner **e-North Carolina Authority**: e-mail: ctorian@e-nc.org (phone: 866.627.8725).

For **"actionable" background information** about how:

- Voice over IP can limit costs, click here
- E-commerce can drive sales, click here
- Videoconferencing can make your staff more efficient, click here

To request a full, customized report for Acme Medicals, Inc., click here

Appendix D

List of Accommodations

APPENDIX D. LIST OF ACCOMMODATIONS

List of Accommodations

Lofoten

Accommodation Name

Anker Brygge AS	Vågan
Ballstad Rorbuer	Vestvågøy
Best Western Lofoten Hotell	Vågan
Best Western Svolvær Hotell Lofoten	Vågan
Bremnes Utleie	Vågan
Brustranda Sjøcamping	Vestvågøy
Eliassen Rorbuer	Moskenes
Finnholmen Brygge	Vågan
Fiskarheimen Værøy	Værøy
Fiskekrogen Henningsvær AS	Vågan
Gjestehuset Det gamle Hotellet	Moskenes
Hammerstad camping	Vågan
Hamnøy Rorbuer	Moskenes
Havly Fiskarheim og Hotel	Røst
Henningsvær Bryggehotell	Vågan
Henningsvær Rorbuer	Vågan
Hotel Aurora	Vågan
Johs. H. Giæver Sjøhus & Rorbuer	Vågan
Justad Rorbuer Og Vandrerhjem	Vestvågøy
Kabelvåg hotell	Vågan
Kalle AS	Vågan
Kornelius Kro	Værøy
Kroghs Feriehus	Moskenes
Kræmmervika Rorbuer	Vestvågøy
Kårøy Rorbucamping	Røst
Lofoten Feriesenter	Vågan
Lofoten Rorbuer AS	Vågan
Lofoten Rorbuferie	Vågan
Lofoten Rorbuferie	Vågan
Lofoten Rorbusuiter	Vågan
Lofoten Sommerhotell	Vågan
Lofoten Værøy brygge	Værøy
Lydersen Rorbuer & Sjøhus	Flakstad
Lyngvær Lofoten Bobilcamping	Vågan

Mildrids Rorbuer	Moskenes
Nord Norsk Klatreskole	Vågan
Nusjfjord Rorbuanlegg	Flakstad
Nybøen sjøhus	Moskenes
Ramberg Gjestegård	Flakstad
Reine Pensjonat AS	Moskenes
Rica Hotel Svolvær	Vågan
Rost Havfiske Camping	Røst
Rostads Rorbuer	Moskenes
Røst Bryggehotell	Røst
Sandvika Fjord & Sjøhuscamping	Vågan
Sildpollnes Sjøcamp	Vågan
Solsiden Brygge	Vestvågøy
Statles Rorbusenter	Vestvågøy
Svinøya Rorbuer AS	Vågan
Svolvær Sjøhuscamp	Vågan
Thon Hotel Lofoten	Vågan
Tyskhella Rorbuferie	Vågan
Villa Lofoten	Vestvågøy
Værøy Gamle Prestegård	Værøy
Vågakallen Sjøhus	Vågan
Ytterviks Rorbuer	Vestvågøy
Å Rorbuer & Brygga Restaurant	Moskenes
Å-Hamna Rorbuer	Moskenes

Oslo

Anker Hostel	Oslo
Anker Hotel	Oslo
Best Western Hotel Bondeheimen	Oslo
Best Western Karl Johan Hotell	Oslo
Bogstad Camp & Turistsenter	Oslo
Clarion Collection Hotel Folketeateret	Oslo
Clarion Collection Hotel Savoy	Oslo
Clarion Hotel Royal Christiania	Oslo
Cochs Pensjonat	Oslo
Doubletree by Hilton Oslo City Centre	Oslo
Ekeberg Camping	Oslo
First Hotel Grims Grenka	Oslo
First Hotel Millennium	Oslo
Fredensborg Apartments	Oslo
Frogner Bed & Breakfast	Oslo

Frogner House Apartments	Oslo
Gjestehuset Lovisenberg	Oslo
Grand Hotel	Oslo
Herbern Marina	Oslo
Holmenkollen Park Hotel Rica	Oslo
Hotel Bristol	Oslo
Hotel Continental	Oslo
Lysebu Hotel	Oslo
My City Home	Oslo
Oslo Apartments	Oslo
Oslo Budget Hotel	Oslo
P-Hotels Oslo	Oslo
Park Inn Oslo	Oslo
Perminalen Hotel	Oslo
Radisson Blu Plaza Hotel Oslo	Oslo
Residence Kristinelund	Oslo
Rica Holberg Hotel	Oslo
Rica Hotel Bygdøy Allé	Oslo
Rica Hotel G20	Oslo
Rica Oslo Hotel	Oslo
Rica Travel Hotel	Oslo
Rica Victoria Hotel	Oslo
Scandic Byporten	Oslo
Scandic Edderkoppen	Oslo
Scandic KNA	Oslo
Scandic Sjølyst	Oslo
Skiforeningens sportsstuer/overnatting	Oslo
Sta. Katarinahjemmet	Oslo
Thon Hotel Astoria	Oslo
Thon Hotel Cecil	Oslo
Thon Hotel Europa	Oslo
Thon Hotel Gyldenløve	Oslo
Thon Hotel Munch	Oslo
Thon Hotel Opera	Oslo
Thon Hotel Oslo Panorama	Oslo
Thon Hotel Slottsparken	Oslo
Thon Hotel Spectrum	Oslo
Thon Hotel Stefan	Oslo
Thon Hotel Terminus	Oslo
Thon Hotel Vika Atrium	Oslo
Tjuvholmen Executive Suites	Oslo
Voksenåsen Kultur- og Konferansehotell	Oslo

Tromsø

ABC Hotel Nord	Tromsø
Amalie Hotell	Tromsø
AMI Hotell Tromsø	Tromsø
City Living Hotel	Tromsø
Clarion Collection Hotel With	Tromsø
Clarion Hotel Bryggen	Tromsø
Grand Nordic Hotel	Tromsø
Homesleep	Tromsø
Quality Hotel Saga	Tromsø
Radisson Blu Hotel	Tromsø
Ramfjord Camping	Tromsø
Rica Ishavshotel	Tromsø
Scandic Hotel Tromsø	Tromsø
Skansen Hotell	Tromsø
Skittenelv Camping	Tromsø
Sommarøy Arctic Hotel	Tromsø
St. Elisabeth Hotell og Helsehus	Tromsø
Sydspissen Hotell	Tromsø
Thon Hotel Polar	Tromsø
Thon Hotel Tromsø	Tromsø
Tromsø Camping	Tromsø
Viking Hotel Tromsø	Tromsø

Appendix E

Invitation to the Follow-up Process

APPENDIX E. INVITATION TO THE FOLLOW-UP PROCESS

Broadband Utilization Benchmarking

Follow-up with Hotell Ullensvang

Steffen André Stople, NTNU

WE WANT TO WORK WITH YOU

Last fall, you participated in a Broadband Utilization study we held in the Hardangerfjord area

We want to thank you for that !

This NTNU study compared individual businesses broadband utilization in the accommodation sector.

Click here to see the report and its findings

Now, we at NTNU and SNG want to give Hotell Ullensvang a feedback on its broadband utilization based on the answers your provided in our online survey.

- Improve your customer service
- Adopt online training methods

We want to help you bridge these gaps !

strategic networks group
the broadband economists

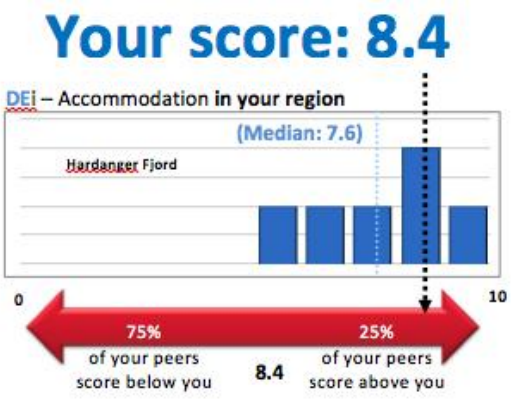
SNG is considered the world leader in the area of Broadband Economics, and their *Digital Economy Index (DEi)* will show exactly where you stand among your peers in your region and in the United States

Steffen André Stople & SNG | Broadband Utilization Benchmarking Project – Follow-up | NTNU 2011

YOUR DIGITAL ECONOMY INDEX SCORE : 8.4 / 10

We want **to use the findings** from this study to **help you** better leverage e-solutions to:

- Make your day-to-day tasks easier
- Uncover new costs savings in daily operations
- Create new revenues sources from using broadband and e-solutions in new ways
- Enhance customer service



Next steps with you

- Setup meeting to review your customized Dei Scorecard
- Discuss which improvements will give you the biggest and most immediate benefits – and set goals
- Develop a workplan to help you realize those benefits

The SNG *DEi-Scorecard* will identify concrete cost saving and new revenues opportunities for you, as well as point out potential areas of improvement in you utilization of e-solutions.

NTNU
100 skapende år

FINAL WORDS

We look forward to your cooperation in this Project – which will run to the end of June 2011

This will be carried out with an **invitation to a web conference**, where we will present to you all the benefits you can gain from improving your broadband utilization

Please let us know when we can **set up the meeting**. Thank you for your time

Best regards,

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strategic networks group
the broadband economists

NTNU
100 skapende år

With the conclusion of this Master's thesis, an amazing chapter in my life is now brought to an end. From the bottom of my heart I wish to thank all my friends and acquaintances in making this a truly memorable journey. I will never forget you.

- Steffen André

"I am not afraid of tomorrow, for I have seen yesterday and I love today."

- William Allen White