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FORFATTER(E)		VEILEDER:  JAN FRICK  PROFESSOR	
Studentnummer:  955229	Navn:  VERONIKA TVEITEVOLL		

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# Abstract

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The subject of broadband connectivity and broadband access is one of the most discussed and less researched areas within public bodies and researchers in the modern society. The current thesis provides an investigation that reveals the drivers that are historically being the main driving force behind investments made in broadband infrastructure in the Northern Sea Region.

Historically, the investments in broadband are being mostly made by private sector telecommunication companies. Nevertheless, latest trends are showing that recently it is the governments that became concerned with investments in broadband infrastructure that, potentially, is beneficial to overall countries' economies in terms of growth and further development, as well is to citizens of the countries.

It has been found that there are different drivers behind public sector and private sector investments. The private companies are mainly concerned of returns on their broadband-based investments and the regulatory environment around it, whiles government are prioritizing to invest in broadband due to its ability to bring both mercantile and social benefits to an entire country.

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# *Introduction*

Digital communications networks are seen as the bedrock of the modern world. Wireless technologies, broadband internet connectivity and satellite systems have transformed such regions as Europe, Northern America and Asia in the best-connected regions of the world. The world we live in is often referred to as a “digital world”, which is characterized by, for example, convergence between computer technologies and communication technologies, constant increase of speed and capacity of these technologies and decline in their cost, increased ease of interfacing between different parts of the Internet, and growth of broadband and mobile communications<sup>1</sup>. It has been acknowledged that Internet-broadband is an important part of everyday life for 1, 5 billion people, which gives access to a wide range of services, for example, online shopping and banking, online job and housing search (Fornfeld, 2008). Regarding Information and Communication Technologies (ICTs), including broadband, it has also been said these are *increasingly* integral part of the economy. They are facilitating the globalization of many services, with broadband making it feasible for producers and consumers of services to be in different geographical locations (OECD, 2007). Governments and private sector in European countries had been investing heavily into broadband infrastructure for years. Communication infrastructure investment, including broadband infrastructure investment, plays important role in total investment within countries and telecommunication operators are among the largest private investors in the economies<sup>2</sup>. Recent economical downturn poses significant challenges for both private and public broadband-based investments. The governments that recognised the economic importance of broadband and included it as a part of their stimulus packages are taking over from the private sector and investing in extending and upgrading high-speed broadband.

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<sup>1</sup> (Govindarajan, 2000)

<sup>2</sup> (OECD, 2009a)

Broadband is commonly seen as one of the fundamental characteristics of globalization. Global broadband utilization by both businesses and individuals has fundamental impact on the way economies work. Broadband connectivity generally seen as technology that can provide better opportunities for producers, consumers, labour force, entrepreneurs and others who want to exploit larger markets and competition, increase business efficiency, contribute to productivity growth, to mention few points. As more and more consumers purchase goods and services online, companies are shifting from traditional sales operations to online sales and internet access, *along with this shift*, which becomes vital for the success of the business. As noted by Gerry McLaughlin from ITContractor.com, “IT [ICT, Internet, broadband] is seen as a way of making the business more efficient and as an enabler of cost-cutting rather than just a cost in itself”<sup>3</sup>. Although there is little empirical evidence of the economic and productivity impact of broadband, the research base is, however, in a state of growth.

Based on a few existing studies about the economic impact of broadband, it has been argued that broadband actually has a very large impact on the services sector as it enables, for example, fragmentation of production and international trade in services that were not previously tradable or contestable. Also, broadband facilitates the development of new inventions, new and improved goods and services, new processes, new business models. Overall it also increases competitiveness and flexibility in economy. A large portion of business communication is currently through the Internet, both within and between firms. Many aspects of producing, consuming, delivering, organization – among others – are now taking place over broadband communications networks, all of which are increasing productivity, efficiency, welfare gains, and potentially contribute to job creation and occupational change (SEC, 2004).

The investment into future broadband may depend on the level of broadband ambitions in a country – it will vary according to the goals of the governments, effects of the finance crisis in a country, amount of new services and businesses demand for faster broadband (Jahren, 2009)

When it comes to estimating future goals and investment needs for future broadband, it is a natural course of action to take OECD (2004) into account the

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<sup>3</sup> (Eclipse, 2009)

future demands on the market. New Generation of Broadband, including fibre and mobile broadband, as well as a few other technologies are co-existing now and are expected to co-exist in the future. Additionally to the existing technologies, there is always a possibility of development even more technologically advanced solutions for broadband.

### **The aim of the thesis**

The aim of this paper is to investigate into the background of broadband-based investment in the countries within the Northern Sea Region, to ascertain what the main drivers for such investments are. The 2 main hypothesis of the current study is that the investigation into the background of broadband-based investment initiatives could reveal a trend whereby the factors of influence could be the same across countries within the Northern Sea Region. Again, the drivers nevertheless, are likely to differ between public and private sector investments.

The main goal is to output a new synthesis up against past research on the relationship between the investment initiatives in building broadband and the driving force, or forces, behind it (the criteria for investment). Towards this goal, a general definition and overview of ICTs and broadband in the Northern Sea Region is given; as well as an analysis of broadband-based investment literature review that is carried out. The findings are discussed in the *Discussion and Results* segment, and in the conclusion; in addition to limitation-of-study acknowledgements made, comments on future direction of the area of research are also put forward.

Due to the nature of broadband and its role in the global arena it is very important to acknowledge the main drivers behind the infrastructure investment in updating existing broadband networks and building new ones. As it is commonly accepted, broadband is an important technology in the modern world both for businesses and individuals, even though there are still doubts, as to whether it is truly as beneficial as it seem, at the same time there has been only few studies that directly dealt with questions of public and private sector motivation behind broadband infrastructure investments. An additional angle of this study is



therefore to look into the nature of investments made by both the public and private sectors in the above mentioned Northern Sea Region and analyse the existing data and interviews from legible sources to find out what exactly drives broadband-based investments and if there are existing significant differences. Not only that, but also to find out whether the existing drivers are likely to change in the future.

### **The design of the study and research methods**

The current study is conducted as an extended literature review and is mostly based on a secondary literature review combined with some empirical research. The empirical research is included in the study to contribute to the refinement and straitening of the theoretical findings. The chosen methodology – an extended literature review – is a sufficient method of enquiry into research regarding broadband-based *investments* and identification of *their* main drivers. Overall, the current line of enquiry presents its own challenges: one is faced with picking out the most relevant and valuable publications and articles directly related to the topic of the current thesis, as well as to correctly evaluate and criticize the reviewed literature (Janskowicz, 2002; Ghauri, 2005).

The presented research includes sampling of data, its analysis and interpretation. The data was sampled by using a methodology of face-to-face interviewing. The interviewees are the public sector employees in Norway whose work is directly related to Norwegian policy in the area of broadband-based investments. In total, 4 employees took part in the study. The participants answered three questions without knowing in advance the questions. The questions were posed by an interviewer. All the answers were recorded using a Dictaphone, recorded information was then synthesised.

The questions are designed to provide data that would show the main trends in the Norwegian policy toward the broadband based investments in this country and other countries within the Northern Sea Region. The questions were as follows:

- 1. What would you say that the main drivers for broadband-based investments are?*

2. *Do you think the main drivers (that you mentioned answering the first question) are likely to change in future broadband-based investments?*
3. *Do you think that the reasons – the drivers – for investment differ from the private sector to the public sector? How do they differ? Why do they differ?*

The first research question is designed to identify main drivers for Norwegian investment in the broadband infrastructure. The second research question is designed to identify whether the existing drivers are likely to change in the future or is it likely that they would stay the same. The third research question is identifying the main differences between drivers for both public and private sector investments in broadband in Norway. Combined and analysed, those three questions, would together tease out and give a rounded overview of the drivers behind the broadband based investments in one of the countries in the Northern Sea Region. The obtained data and the data reviewed from the secondary literature, put together, give a stronger and more accurate judgment and overview of the reality in the discussion segment through to the concluding comments.

### **The structure of the thesis**

The thesis is broken down into six chapters which include an introduction, a theory and literary overview chapter, a methodology and analysis chapter, a result and discussion chapter, a conclusion, and a reflections chapter.

The theory and literary review chapter consist of three parts. The first part presents the general overview of ICT's/broadband and discussion of the impacts it has on businesses and individuals. The second part is mostly focuses on the broadband technologies utilized in the Northern Sea Region (including both its implementation and utilization phases) and the governmental broadband initiatives there. The last part gives an overview of broadband-based investment trends of the past and the impact of the recent financial crisis on such investments. It also includes a detailed description and analysis of broadband-based investment activities undertaken by private and public sectors in the Northern Sea Region.

The Methodology and Analysis chapter include the structure of the current master thesis, the theory behind the chosen research methodology, along with its limitations. Additionally to this, it explains the methods that were chosen to answer the main research questions and includes the full description of stages in the conducted research and its analysis.

The fourth chapter is a Discussion and Result segment – it focuses on subsequent empirical research and various findings. The chapter includes discussion of analysis of reviewed literature and the discussion of the main points of the interview's analysis. The main findings and final results of the papers are also announced in the chapter.

The final two parts of the paper includes conclusions and recommendations for future research into broadband based investments, as well as main limitations of the conducted study are given.

# 1. Theory and Literary Review

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## 1.1. Introduction

The content of the chapter includes detailed description and analysis of role and place of Broadband and ICT in the modern economies, statistical information on the broadband coverage of the households and businesses, as well on globalization and impact of broadband on businesses and individuals. The second and third parts of the chapter present data on broadband related subjects in the Northern Sea Region of Europe and an overview over general broadband policy in EU and national policies of the countries in the mentioned region. The third part of the chapter deals with questions on broadband based investments, analysing differences in motivation behind and drivers for investment initiatives in infrastructure building by public and private sectors. The full definition and broadband based investment along with full historical overview, including major trends and impacts of the recent financial crisis, are also presented in the current chapter.

## 1.2. Information and Communication Technology (ICT)

According to Carlaw (2007), ICTs are technologies that deal with information, doing such things as communicating, analyzing, transforming and storing it. These technologies include speech, writing, the printing press, and many more modern technologies, such as telegraph, telephone, radio and computer<sup>4</sup>. Overall, ICTs are seen as key drivers of productivity and growth (SEC, 2004): many products, both goods and services, have already been created as a result of ICTs and have fully integrated into the everyday and working life of people. Given that all today's technologies were one time in the past, none existent and unknown, it

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<sup>4</sup> (Carlaw, 2007)

is a fair expectation that there will be more new processes, products and organizational innovations beyond what can even be imagined today (OECD, 2007).

### **1.2.1. Broadband and ICT as a General Purpose Technologies**

From a theoretical perspective ICTs, and particularly broadband, can be viewed as so-called general purpose technologies (GPTs), that is to say technological improvements that fundamentally changes how and where economic activity is organized (OECD, 2008). Historical examples of GPTs include electricity and the dynamo, the internal combustion energy, steam engines and railways. Characteristically, a GPT evolves over time with several phases of efficiency, applications and diffusion, it creates spill-over effects throughout the economy and leads to fundamental changes in the production process of those using the new invention, and it spur on further inventions and innovations (Carlaw, 2007). While ICTs are key drivers of productivity and growth and the GPT for today's globalised world, broadband is viewed as ICTs infrastructure enabler and the Internet as the platform supporting variety of applications.

The effect of the GPT-type, according to the 2008 OECD report, suggests that measured total factor of productivity (TFP) should rise in ICT-using sectors (with considerable time lags). However, Basu (2003) notes that investment in ICTs is often associated with declines in TFP because reorganization and learning require resources. Viewing this from the theoretical standpoint of David's (1990) "delay hypothesis" (otherwise known as "learning hypothesis") it is notably supportive of Basu (2003): indicating that it also takes time to learn how to use and apply new technologies, which affect TFP. It is noted that the prices of ICTs have fallen more dramatically than the prices of such GPTs as electricity and combustion engine, even though all of them require complementary investments, it could mean that innovations that drive change may take time to make their contribution (Fernald, 2006). According to the OECD reports for 2004 and 2008c, broadband and associated ICT applications will replicate the positive and

transformative effects of previous GPTs and possibly exceed them. Thus, their effects are expected to build up over time.

Over the past decade ICT policy has progressively shifted its focus from ICT readiness to the impacts of use and the more complex aspects of the “information society” (OECD, 2008) and its efficiency has been growing rapidly.

Even though there are many completely new applications that are regularly appearing in many different parts of the economy (Carlaw, 2007; Crafts, 2003), there is still room for further diffusion of these new ones and all the rest of the existing applications.

### **1.2.2. Broadband as a General Purpose Technology Enabler**

As an enabling technology, broadband is at the core of the diffusion of the information society and ICTs development (SEC, 2004). In the current paper broadband is referred to as “ a wide range of technologies that have been developed to support the delivery of innovative interactive services, equipped with an always-on functionality, providing broad bandwidth capacity that evolves over time, and allowing the simultaneous use of both voice and data” (SEC, 2004. p. 5). Shortly, Broadband connections are immediate and large volumes of data (for example, video/graphical content) that can be almost instantly transmitted to the user.

Various minimum bandwidths have been used in definitions of broadband ranging from 64 Kbit/s to 20.0 + Mbit/s. For example, The United States FCC defined broadband as anything above 768 Kbit/s.<sup>5</sup> In general, according to information provided by Wikipedia<sup>6</sup>, any connection to the customer of 256 Kbit/s (0.256 Mbit/s) or greater is more concisely considered broadband Internet. Household broadband surged, according to different sources (e.g. OECD, 2008) from around 2000. Compared to traditional narrowband connections, broadband changed the overall presentation of the Internet. It has generally diffused more

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<sup>5</sup> (Martin, 2008)

<sup>6</sup> (Wikipedia/1, 2010)

rapidly than narrowband Internet (Table 1.) and is catching up with the PC installed base (OECD, 2008).

*Table 1<sup>7</sup>: Speed of diffusion of selected ICT goods/services in selected OECD countries.*

<i>Estimated number of years to move from ...</i>							
<i>... 20 to 50per cent of households</i>	Canada	Denmark	France	Japan	Holland	Norway	UK
TV	2	..	..	..	..	..	..
Colour TV	..	..	4	3	4	..	..
PC	7	6	7	5	8	7 <sup>1</sup>	7
VCR	3	..	5	5	6		..
Mobile phone	4	3	2	..	..		3
Mobile phone <sup>1</sup>	..	..	3	4	2		..
Internet at home <sup>2</sup>	3,75	3,5	5.5 <sup>1</sup>	..	2,5	2 <sup>1</sup>	4,2
Broadband at home	4	2,2	3 <sup>1</sup>	..	2,2	1.75 <sup>1</sup>	..
<i>... 20 to 40per cent of households</i>							
Internet at home	2,2 5	1,7	4 <sup>1</sup>	..	1,5	1.5 <sup>1</sup>	2
Broadband at home	2,6	1,6	2 <sup>1</sup>	..	1,7	1.25 <sup>1</sup>	1,6

Since the beginning of the century the price on broadband declined and its speed increased, which made high-speed household Internet availability and connection common. Early high-speed Internet users had the usual socio-

<sup>7</sup> OECD estimates, based on data from the OECD Telecom database, Statistics Canada, Cabinet Office (Japan), Statistics Finland, Statistics Netherlands, INSEE and CREDOC (France), and the Office of National Statistics (United Kingdom). 1. Percentage of individuals; 2. Including both narrow and broadband. (OECD, 2007/3)

economic characteristics of early technology adopters (younger, more educated, and richer) but broadband then spread rapidly throughout the population (OECD, 2008). According to the information provided by the ITU, a leading UN agency for information and communication technology issues, the number of countries with commercial broadband available at speeds of 256 kbit/s or more rose from 81 in 2002 to 166 in 2006 (ITU, 2007). And since 2001, the proportion of enterprises connected to Internet via broadband has increased from 19 to 67 present in 2007 (Fornefeld, 2008). The diffusion of high-speed Internet access has thus been very rapid.

Currently, broadband access is mostly provided via what Dicken (2007) refers to as “legacy infrastructure”: a standard phone line, satellite and cable connections. There are different Broadband implementations and standards such as, for example, WiMAX, Local Multipoint Distribution Service, Power Line Communication, High-Speed Packet Access and Other wireless technologies, including IEEE standards and many proprietary wireless protocols. The two most common types of broadband which provides reliable and efficient Internet connection are DSL (Digital Subscriber Line)<sup>8</sup> and cable. In 2006, about 94 per cent of international telecommunications were transmitted via cables (Warf, 2006). Newer technologies in use include VDSL and pushing optical fibre<sup>9</sup> connections. Dicken (2007), on the subject of technologies of particular significance, points to the importance of satellites and fibre cables.

Fibre optics technology enables data to be converted into tiny pulses of light and then transmitted at high speeds through glass fibres wrapped into large capacity telecommunication cables. Not only do optical cables permit very high speed transmission of information, they also have a huge carrying capacity through a strong signal. Satellites are used worldwide in locations where terrestrial Internet access is not available or in locations which move frequently, including vessels at the sea and mobile land vehicles. The most known satellite system is The Intelsat – multi-national consortium of 122 countries whose satellites are positioned to provide complete global coverage (Dicken, 2007).

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<sup>8</sup> DSL is a basic high-speed connection that shares space with the phone line. There are different DSLs: ADSL – Asymmetric Digital Subscriber Line; HDSL – High bit-rate DSL; IDSL – Integrated DSL; VDSL – Very High bit-rate DSL; SDSL – Single Line DSL.

<sup>9</sup> An optical fiber is a glass or plastic fiber that carries light along its length. Optical fibers are widely used in fiber-optic communications, which permits transmission over longer distances and at higher data rates than other forms of communications. (Wikipedia, 2010)



There are also regional (European Eutelsat and some in Asia, Latin America and the Middle East) and private satellite systems. Dicken also argues that “technological developments in satellite and cable technologies have transformed the relationship between geographical distance and the cost of transmitting and receiving information” (p. 86). Broadband is currently available in national and international backbone networks, nevertheless its infrastructure has its own “bottlenecks” – problems of last-mile connection to the final user.

### **1.2.3. Broadband as a Globalization of Goods and Services Enabler**

Broadband is an important enabling technology for structural changes in the economy. Its role is constantly increasing as a result of increasing variety of services traded online and many types of business services becoming internationalized.

As stated by Dicken (2007), technologies of communications (which includes broadband) are influencing how and where business organizations are operating. This ability helped progressively to transform the economic-geographical landscape and made them the key technologies that are transforming relationships on a global scale. As broadband spreads throughout the economy different transformations have taken place in the way business is done, work is organized and resources are allocated (OECD, 2008b). In particular, ICTs and broadband are facilitating the globalization of many services by making it feasible for consumers and producers to be in different locations, as stated above. Many aspects of business in the 21<sup>st</sup> century are now taking place via broadband: for example, supply chain management, fleet management, e-procurement, e-invoicing, online recruitment and so on. It is stated in the research provided by OECD (2008b) that broadband is “especially important in all sectors that rely on the provision of information, especially in financial markets, insurance and accounting firms and systems” (p. 11). Customers in different countries all over the globe make use of the Internet and broadband communication network, for example, for e-commerce, online reservations (holidays, airlines, trains etc.),

online payment systems (banking, bills, retail etc.), blogs, online auctions and many more.

It is noted by OECD specialists (OECD, 2008b), that broadband is contributing to productivity growth by reinforcing competition and increasing a firm's efficiency, it has also broader welfare benefits for customers by increasing the variety and range of available services. According to these specialists the efficiency and productivity gains lead to overall economic growth and additional employment opportunities, both on domestic and international levels.

It is important to note that most exports and imports (around 80 per cent) of all online business services originate in OECD (developed) countries (OECD, 2008b). One of the reasons for this organization-related percentage is due to "borders" in cyberspace which prevents customers in one country to purchase goods/services online from suppliers based in another (a reflection of the digital divide which in turn affects free, borderless trade). For example, purchase of a good requires an address in the particular country, or payments only accepted using credit cards issued in certain countries. Another reason is an "access" problem: although developing countries contain around 75 per cent of the world's population they have only around 12 per cent of the world's telephone lines that could be used for internet access (Dicken, 2007). Therefore, the biggest difficulty in accessing the online business in poor countries is the lack of infrastructure and the immense cost of providing it, especially in rural areas.

Overall, it is obvious that broadband Internet has become an increasingly integral part of people's lives, societies and economies of the countries. It has become a global infrastructure that, for better or worse, interconnects the nations so that changes or occurrences in one country can have a rapid impact on others; it is also part of the technological lifeblood that has advanced the current wave of globalization. Currently, a huge number of existing ICTs applications already rely on broadband, but ever faster speeds and bandwidth continue to increase the range of activities that can be carried out online. For example, public infrastructure is already dependant on broadband communication network: traffic light control, control of sewage systems, air traffic control, GPS, military and defence systems, maritime and rail transport, logistics management systems, and many more (OECD, 2008b).

### **1.2.4. Impacts of Broadband for Businesses and Individuals**

#### ***1.2.4.1. Productivity***

To date, there is still relatively little empirical evidence of economic /productivity impacts of broadband, because of the data availability (first, it is relatively recent phenomenon and second, bandwidth continues to increase and the technologies continue to evolve) and also because of measurement problems (OECD, 2008b). The productivity impact of ITCs has been studied at the aggregate, sectoral and firm-levels. Overall the evidence supports a positive impact from ICTs, and broadband specifically, on productivity. For example, Lehr (2006) examined the productivity impact of broadband on employment, wages and industry mix. They found some evidence showing that broadband *positively* effects growth of employment and growth of the number of overall businesses, yet *negatively* affects growth rates of salaries. However, this pattern of results is not yet fully understood and therefore more research is required.

OECD's Australian analysts<sup>10</sup> found positive productivity impacts from overall ICT, without disentangle broadband. The analysis only focused on productivity effects in new industries, where broadband is expected to matter more than in traditional industries. Their results confirm that it matters much more *what* you do with broadband, and also *how* you do it, rather than just having it. Researchers looking at the firm-level in their studies noted two ways in which broadband impacts on a firm: ITCs are used to (1) make existing processes more efficient and productive (useful characteristics at the heart of any value chain.) or (2) create new e-business processes and business models (OECD, 2008b). The second is expected to have a greater impact, even though it is more difficult to implement and is more costly (yet these provide strong competitive advantages, if such *difficulties* are faced by competitors.). Sadun and Farooqui (cited in Farooqui, 2006) found broadband adoption to be related to e-commerce –

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<sup>10</sup> (Collins P., 2007)

investment in hardware was found to be higher in regions and sectors with broadband availability, also high broadband equipped labour share have higher productivity. Looking at the macro-level analysis, statistical evidence suggests that ICTs mainly contribute to productivity growth as enabler of the improvements in the way business processes are organized (COM, 2008).

Overall, the empirical evidence to date on the productivity impacts of broadband, as acknowledged above, is still quite scant. And as already stated, yet will be expanded, this is due mainly to measurement problems and lack of data. For example, Lehr (2006) points out that even though they found a positive measurable economic effect, to date it remains difficult to draw precise conclusions due to the lack of firm-level and employee-level geographically disaggregated time-series data. Currently, there are several attempts to create ICT-related indicators, which are compatible with macro databases such as EU KLEMS, which can be used in international analysis and comparisons. Confusingly however, empirical evidence based on analyses from data available within the EU KLEMS project at the industry level fails to support the commonly accepted hypotheses of a systematic *positive* or *negative* effect of ICTs on employment in the long run (COM, 2009). As a result, larger productivity/economical effects can be identifiably expected, especially in service sectors, such as communications service, financial service, business service, transportation, real estate, retail, tourism and public services (OECD, 2008b).

#### **1.2.4.2.      *Customer surplus***

It is argued that broadband has a positive impact on consumer surplus; it changes the role of individuals in productive process by facilitating user-created content and user-driven innovation (OECD, 2008b). As an example, high-speed broadband brought the possibility for individuals' greater access to information, which made price comparisons for online (and off-line) shopping easier; it increased competition and downward pressure on prices. Also, broadband enabled access to cheaper goods and services abroad. These are just a couple of obvious examples.

According to the research provided by OECD specialists (2008b), ICTs and particularly broadband are contributing to increasing customer choice by increased customization – a phenomenon where the Internet revealing markets for products that had little demand for. Also, they state that as supply chain and inventory management becomes more sophisticated, and additional ways of online retailing develops (e.g., on web sites such as e-Bay), consumer surplus can be expected to continue to increase.

#### ***1.2.4.3. Social impact***

A few researchers tried to measure the social impact of broadband. Australian Bureau of Statistics<sup>11</sup> states that the scope of “social impact” can be very large, because individuals, families or whole society may be affected by broadband. These points of impact can either be temporary or permanent, negative or positive, direct or indirect. For example, broadband can have an impact on how and where people work, what they study, how they do everyday activities (banking, shopping, etc), how they spend their income and their time, to mention a few points (ABS, 2008-09). One of the surveys made by British BT Business in 2007 reveals that broadband is a key enabler in flexible work practices, both when it comes to *times/hours worked* and *location* from where people worked. The survey shows that one third of British SMEs and fifty percent of sole-trader businesses are creating a better work-life balance by utilizing broadband via working more away from the office<sup>12</sup>. A case study on social impact of broadband Internet by Selouani and Hamam (Hamam, 2007) notes that there are many examples of new uses and activities caused by broadband Internet; respondents noted that overall effect of broadband led to positive changes in their lives. However, while this is the case, comparatively, in few cases broadband Internet usage resulted in changes of behaviours, attitudes, relationships, and operating norms.

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<sup>11</sup> (ABS, 2008-09)

<sup>12</sup> (BT Business, 2007)

#### ***1.2.4.4. Platform for innovation and growth***

New networks are seen to be an important platform for innovation and growth in many different sectors of the economy, for research, for international co-operation and for creativity<sup>13</sup>. Many future innovations may be directly linked to the availability of high speed network and new applications they support. Many “broadband-based” innovative services are visibly emerging in four sectors: health, electricity, education and transportation<sup>14</sup>. For example, broadband improves access to digital learning resources, encouraging communication among schools, teachers and pupils, linking different levels of databases for administrative purposes, giving access to database of study literature for students and many others. When it comes to health issues, broadband has a large impact on developing new e-health applications; for example, it increases the potential for more doctor-to-patient interaction between doctors at hospitals and patients at home, increasing the efficiency of health monitoring via remote consultations and many others. With the availability of broadband it became easier to collect and timely distribute, for example, transportation information, information for the traffic control systems, for route planning just to mention a few. Many applications for the electricity sector are surfacing, for example, advanced metering infrastructure, visibility of the electricity consumptions for end-users, also application managing electricity storage, are some cases in point (OECD, 2009/2).

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<sup>13</sup> (OECD, 2009/1)

<sup>14</sup> (OECD, 2009/2), p.5

### **1.3. The Northern Sea Region**

As introduced at the outset, the first part of the current chapter presents a detailed broadband overview in the Northern Sea Region with reference to the following two phases: the implementation phase (results and future directions) and the utilization phase (overview and potential). The second part of the current chapter highlights the governmental policy towards broadband development in the Northern Sea Region.

#### **1.3.1. Detailed Broadband Overview in the Northern Sea Region**

The broadband overview in the Northern Sea Region in the current thesis is mostly focused on providing information on the fixed broadband access with capacity under 10 Mbit/s in the following countries: Belgium, the Netherlands, Germany, Denmark, Sweden, the UK and Norway. The reason is that this capacity is the maximal capacity of the traditional telephone wires that ADSL technology is using to deliver broadband. The so-called Next Generation Broadband (NGB) or Next Generation Access (NGA) is packet-routed networks, mostly using internet protocol (IP) that is progressively replacing conventional circuit-switched network. NGBs (NGAs) are commonly known as an ultra high-speed broadband access to the end user primarily through optical fibre. There is yet little information found about the next generation broadband with speed over 10+ Mbit/s, even though 100 Mbit/s has become economically feasible and deployments has started in such countries as, for example, Belgium, the Netherlands, the UK and Germany. Overall, in the current EU 27, at the end of 2008 less than 5 per cent of all fixed connections provided speeds in excess of 30 Mbit/s (COM, 2009).

### ***1.3.1.1. Implementation – results and future directions***

Broadband coverage and penetration presented in the current paper's statistical data reflects the results of the implementation phase in the Northern Sea Region and other EU countries. Broadband coverage, in that respect, represents the availability of the broadband infrastructure – in other words, the amount of households or companies that have the possibility of subscribing to a broadband connection. Broadband penetration is seen in the current thesis as representation of the actual broadband connectivity among a population or business.

Analysis of the data and relevant literature shows that during the implementation phase of broadband deployment the competition between incumbent and new entrant telecommunications service providers offering DSL technologies was improved by local-loop unbundling regulations. Furthermore, in countries equipped with a cable TV infrastructure, competition between DSL and cable modem technologies has increased the dynamism and investment levels in broadband infrastructures (Fornfeld, 2008). In 2006, for example, according to Fornfeld (2008), DSL technologies were available to 82 per cent of the population in the EU27. In 2008, according to the Eurostat, the average number of the companies having access to broadband was 81 per cent in the EU27 and 86 per cent on average in the Northern Sea Region (Table.2). Broadband connections across the EU rose to a total of 110, 5 million connections, representing 22, 5 per cent of Europe's population, according to ECTA's twice-yearly EU Broadband Scorecard, published in March 2009 (ECTA, 2009).



Table 2<sup>15</sup>: Enterprises which have broadband access - Percentage of enterprises with at least 10 persons employed in the given NACE sectors.

Geo	2003	2004	2005	2006	2007	2008
<b>European Union (27 countries)</b>	:	46	62	73	77	81
<b>Belgium</b>	49	70	78	84	86	91
<b>Denmark</b>	69	80	82	83	80	80
<b>Germany</b>	42	54	62	73	80	84
<b>Netherlands</b>	37	54	71	82	87	86
<b>Sweden</b>	62	:	83	89	87	89
<b>United Kingdom</b>	27	50	65	77	78	87
<b>Norway</b>	47	60	78	86	85	86

As for the penetration rates, price declines and speed increases have made high-speed household internet availability and connection increasingly common even if uptake has differed among the EU27 countries and specifically in the Northern Sea Region (Table.3). On average, the penetration rate in the Northern Sea Region countries in 2008 was 31, 2 per cent, while the EU average was 20 per cent, with highest figures in the Netherlands and lowest in Germany. Leaders in broadband – Denmark, Norway, Sweden and the Netherlands – all have penetration rates exceeding 30 per cent, with the UK not far behind. Common to all these top-ranked countries is strong competition from both cable and regulated unbundling of the local loop (ECTA, 2009).

The penetration rates for fibre in 2008 were 0,3 per cent on average in the EU27. Among countries in the Northern Sea Region the rate was highest in Sweden – 5, 6 per cent of the population. Also, Sweden boasts the fastest broadband speeds used by consumers with more than 30 per cent having speeds over 2Mbit/s and 10 per cent having speeds higher than 10Mbit/s (ECTA, 2009).

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<sup>15</sup> (Eurostat, 2009)

Data on wireless broadband coverage as advanced fixed technologies UMTS (3G), WiFi and WiMax and to a certain extent satellite are not yet available.

*Table 3<sup>16</sup>: Broadband penetration historical time series, per 100 inhabitants, all technologies:*

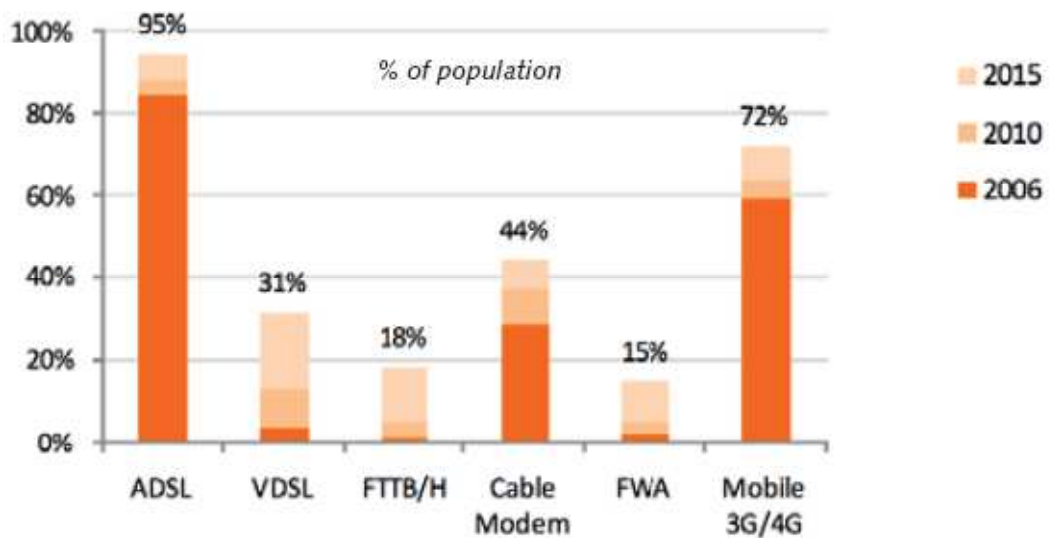
<b>Geo</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>Belgium</b>	1.4	4.4	8.7	11.7	15.5	18.2	22.3	25.7	26.4
<b>Denmark</b>	1.3	4.4	8.2	13.1	19.0	24.9	31.8	35.1	36.7
<b>Germany</b>	0.2	2.3	3.9	5.6	8.4	13.0	17.1	23.8	26.2
<b>Netherlands</b>	1.6	3.8	7.0	11.8	19.0	25.2	31.8	34.9	35.5
<b>Norway</b>	0.4	1.9	4.2	8.0	14.8	21.8	27.4	31.2	33.4
<b>Sweden</b>	1.7	5.2	8.2	10.9	14.9	20.7	26.4	30.3	32.3
<b>UK</b>	0.1	0.6	2.3	5.4	10.4	16.3	21.4	25.8	27.6

When it comes to the future directions of the European broadband, ADSL and cable modem are expected to remain the main broadband technologies in Europe with ADSL coverage expected to reach 95 per cent of the population in 2015, as indicative of Figure.1 (Fornefeld, 2008). Nevertheless, due to the geography and distribution of the population in some countries 100 per cent or even 95 per cent coverage of wired networks will probably never be reached (COM, 2009). Currently, only smaller and flat countries like Belgium, the Netherlands or Denmark exhibit 100 per cent rates of coverage, even in rural areas.

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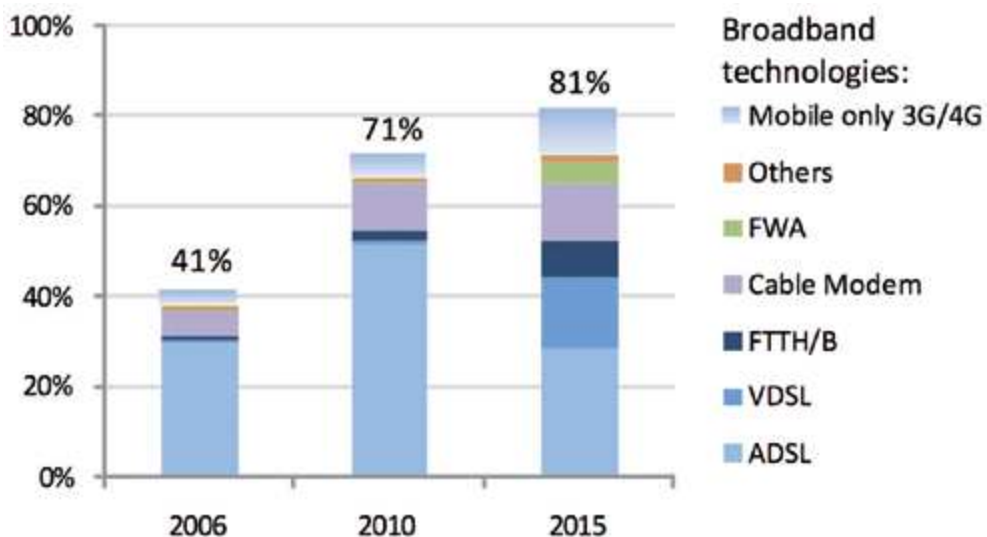
<sup>16</sup> (OECD, 2010)

Figure 1<sup>17</sup>: Broadband coverage in the EU27 until 2015.



The total broadband penetration rate is expected to grow to 81 per cent in all households in Europe by 2015 (Figure.2). The ADSL and cable modem infrastructure has almost reached complete coverage in the largest EU countries, so further broadband penetration is expected to continue to increase by filling up the available capacity of the existing infrastructure (Fornfeld, 2008).

Figure 2<sup>18</sup>: Total broadband penetrations in the EU27 until 2015.



<sup>17</sup> (Fornfeld, 2008) Figure 63 - Broadband coverage in the EU27 until 2015.

<sup>18</sup> (Fornfeld, 2008) Figure 65 - Total broadband penetrations in the EU27 until 2015.

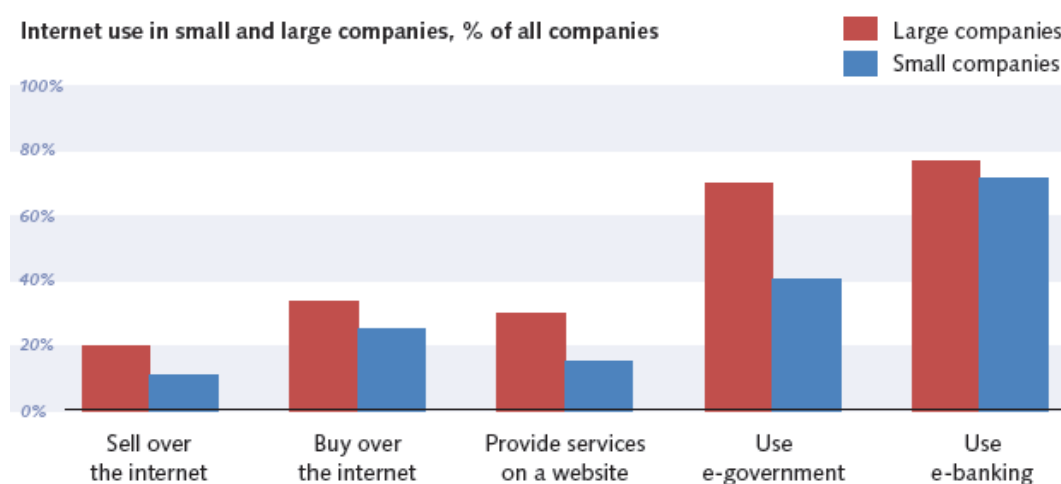
The demand for ever higher speed of connectivity, as mentioned above, is still growing. Therefore, local access networks require constant improvement. There are several research projects in Europe at the moment that are focused on finding solutions for achieving these ambitious plans of broadband providers and governments. For example, “Multi-Service Access Everywhere” developed architecture solutions for network interfaces, low-cost access network technologies including optical fibre, fixed wireless access, xDSL and many more next-generation access technologies (NGAs). It is expected that this new-generation broadband access infrastructure will underpin economic development in all EU states in the nearest future, and will be the origin of new services and business opportunities throughout the economy, as can be concluded from reviewing the broadband-related literature. According to the European internet services providers development plans, they do not intend to develop the VDSL and FTTH/B infrastructure on a wide scale in the short term, nevertheless a dynamic investment in fixed-link broadband infrastructure will strongly increase over the period 2010–2015 in order to develop the optical-fibre networking in the short term (Fornefeld, 2008).

#### ***1.3.1.2. Utilization phase – overview and potential***

A study conducted on behalf of the European Commission covering the impact of broadband on productivity and growth shows that construction of a high-capacity infrastructure is not sufficient to make a population use broadband technologies (Fornefeld, 2008). Many people, as well as businesses, with the possibility of using broadband simply lack the skills to take advantage of the technology, or do not realize the benefits that they could obtain by properly using the internet for personal use or at work. For example, the evidence collected by the Commission of European Communities (COM, 2009) shows that the main reported reasons for households not having an internet/broadband connection is *lack of need*, *costs* and *lack of skills*. These barriers are larger for those who have lower income. People and companies with a broadband connection may make little use of the possibilities of broadband technology. For example, many small businesses are

not aware of the benefits of developing their business over the internet (Fornefeld, 2008). The results in Figure.3 show that small companies use far fewer of the internet's possibilities than large ones. Nevertheless, a survey performed on small and micro companies using broadband in Cornwall (UK) (Kox, 2005) states that once small companies learn about and take advantage of broadband technologies, a very large majority of them (91 per cent) consider that the impact on their business is positive. It is very important to note that in 2006, according to Fornefeld (2008), about 10 per cent of the companies in the EU that were using different online services did not have broadband connection. They use deal-up modems on the analogue telephone infrastructure or ISDN. Recently, in 2009-10, the number of such companies is assumed to make up less than 10 per cent (that is to say at the time of writing), even though there is no recent available data. Therefore, all the statistical information about the companies utilizing Internet for business purposes is directly seen as information that is applicable for usage when talking about utilizing broadband connectivity for business purposes.

Figure 3<sup>19</sup>: Internet use in small and large companies.



Realistically speaking, broadband is not required for some simple forms of e-banking, e-government, online purchases and e-mails, nevertheless it becomes quickly an important advantage when trying to integrate the internet into the company's processes such as accounting, procurement or customer relating all economic sectors (Fornefeld, 2008). In many cases, even ADSL connections with

<sup>19</sup> (Fornefeld, 2008) Figure 10 - Internet use in small and large companies.

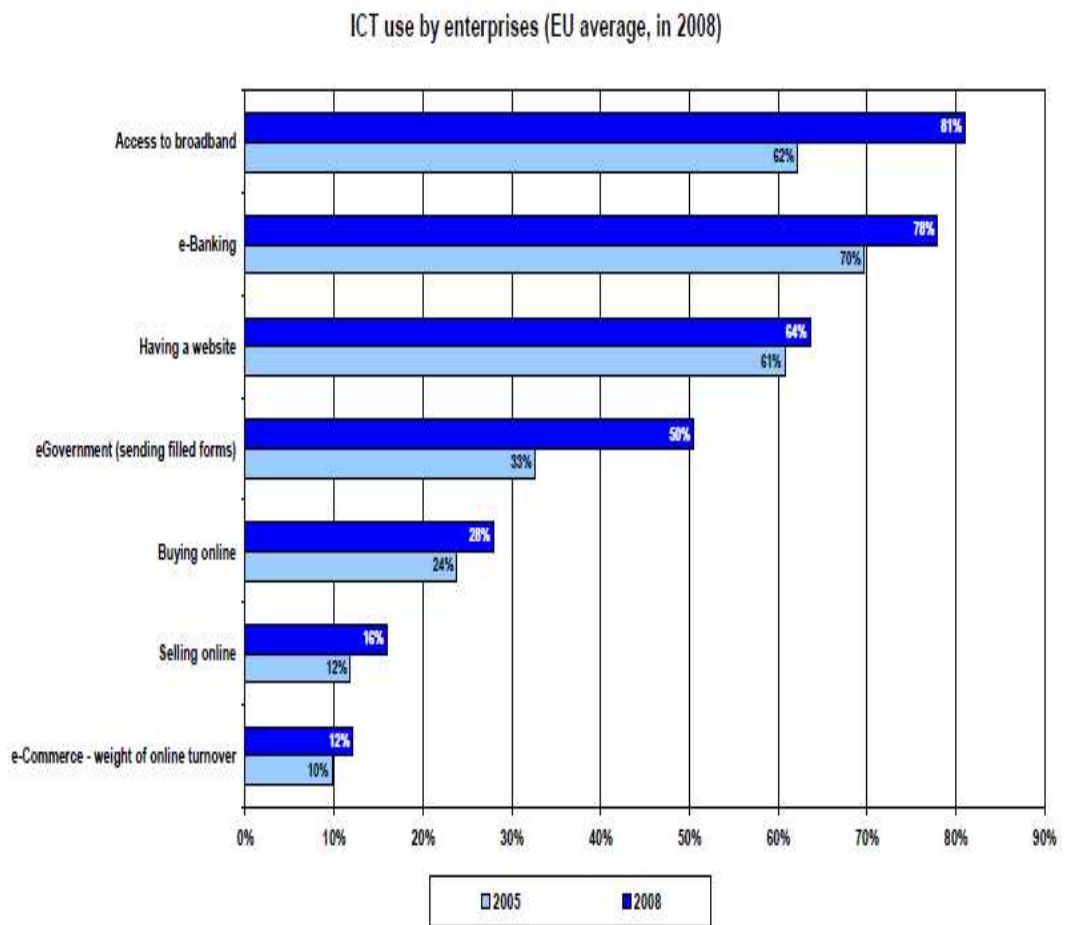
more than 1Mbit/s download rate are insufficient. For example, the five companies that were analyzed for the case study in Cornwall (Fox, 2005) have access to the internet through ADSL and are looking forward to further developing their online activities when connected with faster internet access. None of them have more than 25 employees and only one is an IT service provider.

The overall picture of how companies are utilizing internet and broadband possibilities shows that the most used form of e-business in Europe is online banking (78 per cent of companies), followed by the use of a company website (64 per cent, half of which provide after-sales support) and transitive e-government (50 per cent). On average, 28 per cent of European companies purchase over the internet, 16 per cent sell their goods and services online (Figure.4). *Figure 4* clearly shows that while connectivity is now high, the actual implementation of use of ICT in business processes is still limited. For example, it is common among European companies to have a webpage (64 per cent), nevertheless, as additional evidence on e-commerce take-up, available from statistics on website functionalities, shows that the services that are actually available through this webpage are limited. In particular, while 57 per cent of the websites contain product catalogues and price lists only 26 per cent allow for online ordering or booking, and approximately 10 per cent allow for payment (COM, 2009)<sup>20</sup>.

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<sup>20</sup> The data is presented as on average for the companies in EU27. However, there are large differences across industries, reflecting their activities.

Figure 4<sup>21</sup>: ICT usage by enterprises.



As mentioned above, the internet is used by most European companies to exchange information with their banks. The reason is that banks are able to use information technologies internally and provide secure, easy-to-use e-banking websites to their customers. Therefore, integration of a company's processes with the bank's information system, such as a secure electronic payment device at a shop's checkout, requires an always-on connection between the bank and its customer, thus making broadband availability an essential advantage (Fornefeld, 2008).

It is indicated in Eurostat's survey from 2009 that in the EU27 2 out of 3 enterprises use the Internet for interaction with public authorities, mostly for obtaining information and forms (Figure.5). It is estimated that this number is even higher now in 2011, even though the data is not available yet. The number

<sup>21</sup> (Fornefeld, 2008) Figure 1 - ICT use by enterprises (EU average, in 2008)

of companies using the Internet for interaction with public authorities was 72 per cent on average in EU27, with 90 per cent in Denmark, 86 per cent in Sweden and 83 per cent both in the Netherlands and Norway, as the leaders (Table.4). As indicated by Eurostat in 2006 in their Community survey on ICT use in enterprises (Eurostat, 2006) countries of Northern Sea Region are using e-banking and e-government services far more than on average in the rest of the EU. Over 80 per cent of businesses in countries such as Denmark, Sweden and Norway are using e-banking and over 45 per cent of the enterprises in these countries are using e-government.

*Table 4<sup>22</sup>: Enterprises using Internet for interaction with public authorities.*

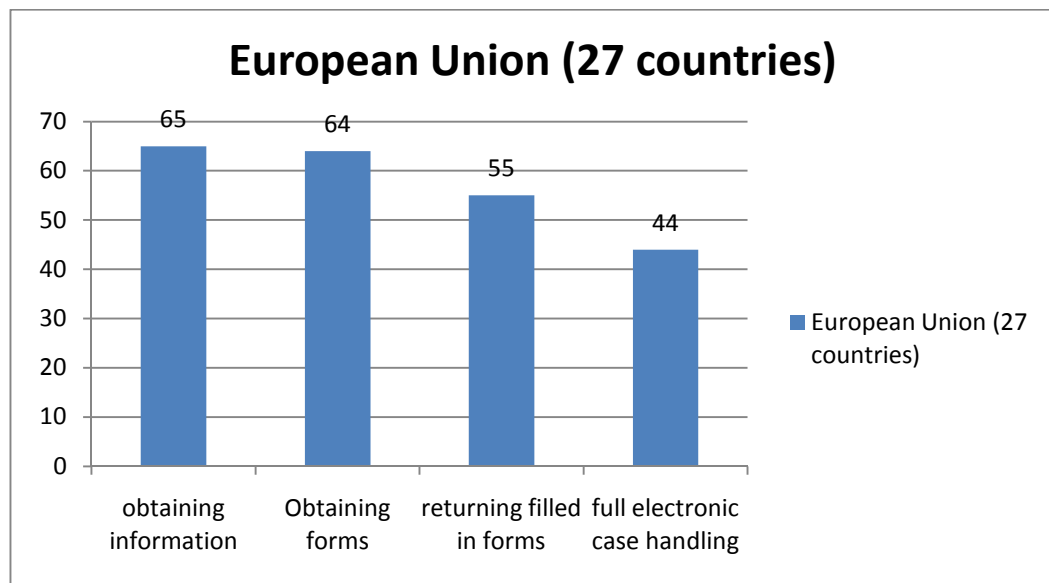
<b>Geo</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
<b>European Union (27 countries)</b>	:	51	57	63	65	68	72
<b>Belgium</b>	:	60	61	59	51	69	81
<b>Denmark</b>	75	85	87	87	88	90	90
<b>Germany</b>	35	36	44	49	56	56	65
<b>Netherlands</b>	41	47	57	70	81	85	83
<b>Sweden</b>	:	92	80	80	79	78	86
<b>United Kingdom</b>	:	34	39	52	54	64	68
<b>Norway</b>	65	69	84	74	71	76	83

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<sup>22</sup> (Eurostat, 2009a)



Figure 5<sup>23</sup>: Enterprises using the Internet to interact with public authorities, by purpose (2009), EU27 in per cent.

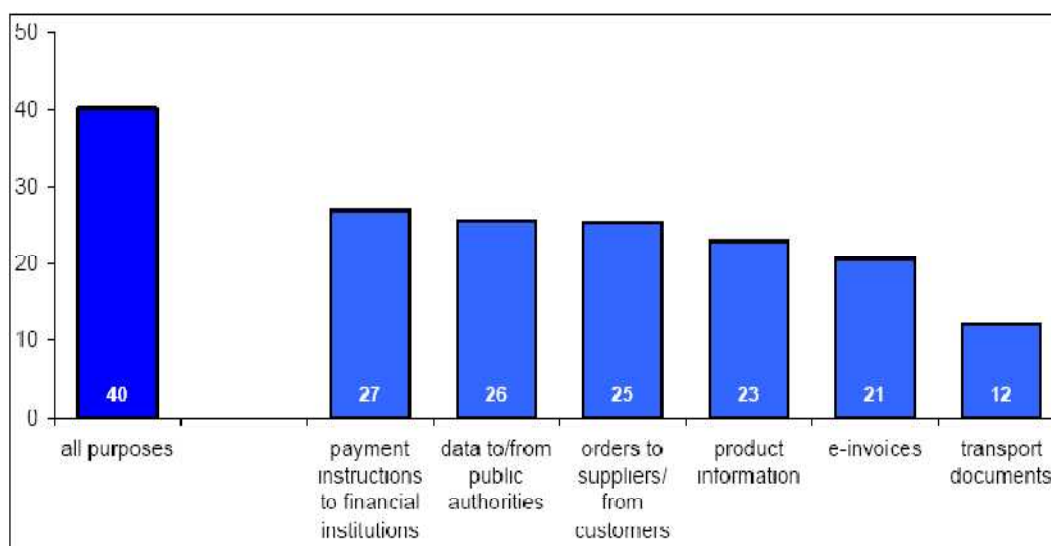


When it comes to e-commerce, companies use the internet to find information about providers more easily and to buy online certain kinds of goods. The countries of the Northern Sea region are obvious leaders in utilizing the internet for purchasing or selling, with the exception for Belgium in both cases (Fornfeld, 2008). Purchasing and selling online occur over a website or an online shop, for regular customer–supplier relations, orders are directly transferred over the internet from the customer’s IT system to the supplier’s IT system. Such links between companies’ IT systems facilitate greater efficiency, for example, in allowing the transfer of orders and invoices. It can also be developed further, into a more complete sharing of information about stocks, processes, research and developments, planning or sales. As stated by Eurostat (2008), only 40 per cent of all enterprises in Europe exchange data automatically with other entities (Figure.6). This figure shows that eBusiness applications that enable the automatic link between business partners are still used by a minority of EU enterprises. For example, on average only 21 per cent of the enterprises in the EU27 are sending and receiving e-invoices automatically. As reflected by Table.5, in 2008 the absolute leader in the e-invoicing in Northern Sea Region was Denmark, where 43 per cent of enterprises were using that service, nevertheless, already a year later, it

<sup>23</sup> (Eurostat, 2009b)

was Belgium who proved to use the service the most at 40 per cent, with the UK as the country using the least amount of e-invoicing at 11 per cent in 2008 and even lower in 2009 at only 9 per cent.

*Figure 6<sup>24</sup>: Automated data exchange between the enterprise and ICT systems outside the own enterprise.*



*Table 5<sup>25</sup>: Enterprises sending and/or receiving e-invoices.*

Geo	2007	2008	2009
<b>European Union (27 countries)</b>	18	21	23
<b>Belgium</b>	31	36	40
<b>Denmark</b>	37	43	38
<b>Germany</b>	19	27	32
<b>Netherlands</b>	11	29	34
<b>Sweden</b>	18	17	25
<b>United Kingdom</b>	15	11	9
<b>Norway</b>	29	31	32

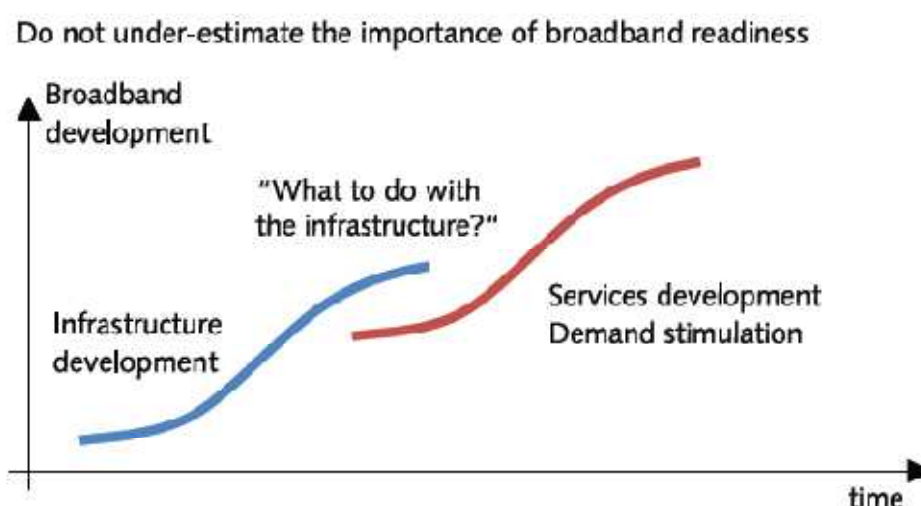
<sup>24</sup> (Eurostat, 2008)Figure 4: Automated data exchange between the enterprise and ICT systems outside the own enterprise, by purpose, EU27, January 2008 (per cent)

<sup>25</sup> (Eurostat, 2009c) Enterprises sending and/or receiving e-invoices - [tin00114]

The usage of broadband internet communications has a great potential in the nearest future. ICT is expected to provide further benefits to business through the difference of more recent technologies (such as, for example, RFID applications<sup>26</sup>, person identification, production tracking and many others) which are being increasingly deployed in the economy and are considered to be beneficial for the companies utilizing them (COM, 2009). Overall, as one can see, the significant progress in utilizing broadband for business purposes had been made in connectivity, e-banking and uptake of online public services. Such areas as e-commerce, automation of internal business processes, e-business applications enabling automatic link with business partners and other ICT solutions are the areas that have the potential for further development.

As pointed out earlier in the paper, the communication companies and research institutions are working on the NGB technological and infrastructure solutions to make broadband available to as many as 81 per cent of households by 2015, including households using broadband over mobile technologies. As noted by specialists from the European Commission (Fornefeld, 2008), not only broadband infrastructure development has an impact on the use of services via broadband, but also broadband readiness as graphically represented in Figure.7.

*Figure 7<sup>27</sup>: Broadband readiness is as important as infrastructure development.*



<sup>26</sup> Radio Frequency Identification

<sup>27</sup> (Fornefeld, 2008) Figure 19 – Broadband readiness is as important as infrastructure development, p. 32

By broadband readiness, or demand stimulation, Fornefeld (2008) means activities that are encouraging companies to develop online services or to use the internet to integrate their processes with the processes of their customers, suppliers, service providers and so on. It is important, therefore, for the companies and governments not to underestimate the importance of broadband readiness. Nevertheless, and so far, most broadband strategies have been aimed at infrastructure development, in particular: to increase broadband coverage in remote areas. The main focus of the governmental policies should also be on some projects or initiatives that will stimulate individuals and companies to use broadband internet. Because so far in many cases broadband development lacks social and economic impact, and investments are not as beneficial as expected (Fornefeld, 2008). Examples of demand stimulation campaigns for further utilization of broadband may include demonstration campaigns in social events for employees and owners of organizations, the presence in companies of IT equipment and professionals specially trained to support individuals in their use of the internet, involvement of professional organizations, such as Chambers of Commerce, to promote the use of internet technologies in small and medium companies. It is absolutely clear that businesses need involvement of official authorities for initialization of some of these events and for support of their initiatives of broadband usage. Therefore, broadband policies in the Northern Sea Region countries, including both the legal and R&D initiatives, should be supportive and stimulating toward wider and more intensive usage of online services and other business activities via broadband.

### **1.3.2. Governmental Policy towards Broadband Development in the Northern Sea Region**

The potential benefits of broadband are well recognized in the European countries. Member States (EU27), as well as other countries in Europe, are already exploiting these benefits and are very interested in further development of broadband strategies, which contain a wide array of initiatives both on the supply side (infrastructure development) and on the demand side (increased usage) of the

market (SEC, 2004). The current paper looks at current strategies of Northern Sea Region countries from two perspectives: their initiatives as EU27 member states and their initiatives as national broadband strategies.

### ***1.3.2.1. Recent EU Broadband Strategies***

Two most noticeable EU policies that focus on the broadband development in Europe are eEurope 2005 and i2010. eEurope 2005 was launched at the Seville European Council in June 2002; its aim was to develop modern public services and a dynamic environment for e-business through widespread availability of broadband access at competitive prices and a secure information infrastructure. The program was successfully completed at the end of 2005.

In 2005 the European Commission set out a new strategic framework for the Information Society i2010 – a European Information Society for growth and employment. It is a key element of the renewed Lisbon Strategy and offers a comprehensive strategy for ICT and media sector. One of i2010's main objectives is the development of a Single European Information Space that would offer affordable and secure high-bandwidth communications. It also aims to ensure that Europe's citizens, businesses and governments make the best use of ICTs in order to improve industrial competitiveness, support growth and the creation of jobs and to help address key societal challenges (COM, 2009).

### ***1.3.2.2. Broadband Strategies Implemented in the Northern Sea Region***

The current paper focuses on giving an overview over existing Broadband strategies in the seven countries of the mentioned region. Literature reviewed for the current paper shows that most countries in the Northern Sea Region tend to follow similar Broadband strategies. Back in 2004 specialists of the Commission

of European Communities, after analyzing broadband strategies of different countries, noted that broadband policy initiatives are based on similar principles, as, for example, recognition of the primary role of the market in the expansion of broadband, and the role of public policy when it comes to complementing the effective functioning of the market (SEC, 2004). Governments base their policies understanding the importance of broadband development, that enabling open and interoperable applications and services for businesses and administrations and the need to overcome barriers to the development of new innovative content (IPR protection, DRM systems, m-payments and many others), as well as secure and stimulate the trust in the use of broadband. ICT policies are also focusing on the stimulation of broadband utilization through, for example, consistent implementation of the new regulatory framework for electronic communications, or assessment of broadband availability and take-up, also by supporting R&D for the development of next-generation broadband, new applications and services (SEC, 2004).

Generally, there are several priority-areas for governments of different countries. The areas that governments of the Northern Sea Region are primarily focusing on are: Infrastructure and Broadband diffusion<sup>28</sup>; e-Government<sup>29</sup>; e-Learning and eScience<sup>30</sup>; ICT R&D and innovation; eInclusion/digital literacy<sup>31</sup>; eCommerce and eBusiness. Countries of the region, when it comes to broadband infrastructure deployment, put an emphasis on policies to increase the coverage of broadband. In all countries of the Northern Sea Region broadband coverage is approaching 100 per cent (IDATE, 2008). The new German broadband strategy, for example, envisages achieving country-wide availability of high capacity broadband connections latest by the end of 2010; the other goal is to make broadband connections of at least 50 Mbit/s available to 75 per cent of the German households by 2014<sup>32</sup>. Policies are also being implemented to extend the coverage of wireless networks (particularly in urban regions) and the coverage of mobile services. As an example, Sweden, Denmark and the UK are introducing their own regulations and strategies of reorganization of their radio spectrum in

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<sup>28</sup> The diffusion of broadband infrastructure and ICT equipment.

<sup>29</sup> The implementation of ICTs within government and for the provision of government services.

<sup>30</sup> Integration of ICT into the educational system

<sup>31</sup> The development of digital skills

<sup>32</sup> (BMW, 2009)

order to increase its use or to make way for mobile digital television and further development of broadband. The UK had presented its own ICT strategy “Digital Britain”. The program is developed to “assist the private sector in delivering an effective modern communications infrastructure and proposals to assist the development of next generation broadband to those areas that will not benefit from commercial deployments; to enable Britain to be a global centre for the creative industries in the digital age, including public service content, within a clear and fair legal framework; to ensure that people have the capabilities and skills to flourish in the digital economy, and that all can participate in digital society; and actions to modernize and improve its service to the taxpayer through digital procurement and the digital delivery of public services” (COM, 2009).

Governments of some European countries are heavily investing in optic networks, which are already integrated for general use by population – for example, the Netherlands has committed itself to 100 per cent optic networks – while other governmental investments are quite limited to the scientific community (eScience), for example Germany and Belgium, which are investing in projects designed to increase existing ICT capacity (COM, 2009). In addition to the infrastructure-related projects, countries of the Northern Sea Region (Belgium, Denmark, Sweden and UK) are implementing different strategies which are designed to increase the up-take and use of broadband through the encouragement of competition. For example, Belgium in 2006-2007 had a project called “Internet for all” that aimed to encourage the use of broadband. The project provided a package for the general public, including broadband access, a computer and training course with subsequent VAT reimbursement<sup>33</sup>.

Norway, additionally to following most of the EU broadband directives, announced in 2000 its very own national ICT strategy. The strategy was called eNorway 1.0. Back then, the strategy included five main directions: individual, culture, and the environment; industries; workforce; the government; and education (Strande, 2007). The first three eNorway plans (eNorway 1.0, 2.0, 3.0) was to a great extent a visualization of concrete development within the various ministries. Norwegian Ministry of Government Administration and Reform (Department of ICT policy) is responsible, among other things, for the policy

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<sup>33</sup> (Epractice.eu, 2008)

associated with the development of broadband coverage, making broadband available throughout the country, also it is responsible for taking initiatives and coordinating the development of an electronic administration where access to public services is a major issue<sup>34</sup>. The current Norwegian strategy is focusing on the three target areas: the individual in the digital Norway; innovation and growth in business and industry; and a coordinated and user-adapted public sector. Norway's goal is to achieve 100 per cent broadband coverage for its population and in 2008 the government spent around 190 million NOK on broadband development. For example, one of the programs the Norwegian government is working on is *Norway digital*. This initiative is about to build the national geographical infrastructure in support of e-Government (Strande, 2007). The program's aim is to enhance the availability and use of quality geographic information among a broad range of users, primarily in the public sector. Another initiative of Norwegian government is e-Inclusion strategy, also called "an information society for all", that had been presented in 2006 and is one of the targets areas within eNorway policy. E-Inclusion is based on three pillars: access to the Internet, equipment and content; universal design; and digital literacy and competence. Currently, Norway is working on achieving the goals of an overall eNorway policy and goals of e-Inclusion in particular.

Whether countries in the Northern Sea Region have integrated national ICT strategy with overall EU strategy, the types of initiatives employed across countries are often similar. The area of ePublic services broadly includes policies in the areas of eGovernment, eHealth, eJustice and eLearning. To encourage the use of internet/broadband and digital literacy (eLearning) many countries in the Northern Sea region are increasing the availability of broadband in schools. For example, Belgium had initiated the "Cyberclasses" project in 2008 to equip all schools in the French speaking community with computers, servers and broadband (ADSL) by 2010 (COM, 2009). The Netherlands eLearning strategy is also focusing on infrastructure at schools, as well as teachers' and students' skills and resources<sup>35</sup>. Also, the Netherlands, as well as Belgium, is working toward encouraging the use of ICT by SMEs. In order to promote use of ICTs by public and private sector Norway developed "IT-Funk", a program that will run until

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<sup>34</sup> (FAD, 2007)

<sup>35</sup> (Newrly, 2009)



2012, the main aim of which is to support accessibility for all – including the disabled – to the information and communication technology and to society through the use of ICT<sup>36</sup>.

All countries of the Northern Sea Region are actively implementing policies and strategies in the area of eGovernment and the i2010 eGovernment action plan. Within governments, national strategies include the expansion of office automation, the digitalisation of public administration, the networking of national (central, local) governmental departments and the implementation of electronic public procurement (eProcurement) (COM, 2009). For example, in Norway, most of the eGovernment initiatives are targeted to providing information to citizens and providing eServices to business and individuals<sup>37</sup>. Swedish government set a goal of regaining a leading position in the eGovernment area by 2010 by having “the world's simplest Administration”<sup>38</sup>. eProcurement is seen by governments as a particularly important “high impact service” and they are currently working on several large-scale projects for achieving 100 per cent availability and 50 per cent effective use of eProcurement by 2010, and also better cooperation between their administrations and beyond national borders (COM, 2009).

Overall, it is clear that governments of the Northern Sea Region countries recognized the important role that ICT plays in modern knowledge economies and develop policies and strategies to support further development and use of broadband both for their citizens and businesses.

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<sup>36</sup> (Forskningsrådet, 2007)

<sup>37</sup> (Epractice.eu, 2010)

<sup>38</sup> (Epractice.eu, 2010/1)

## **1.4. Broadband-based investments**

First of all, it is noteworthy that this section deals with investments that are directly related to broadband infrastructure build either by the public sector or private sector in the Northern Sea Region. The current paper deals with many concepts that are specific to the area of investment in the telecommunication sector, namely, broadband. Therefore, it is very important to clarify that the term “broadband-based investment” means broadband network or infrastructure investment regardless of the technology, i.e. it includes investments in building fixed-line communication infrastructure, fibre, wireless etc.

Secondly, the section only includes data from telecommunication markets and do not include investments made by some ISP (Internet Service Providers), companies created to provide internet and broadband access to the end-users, which are not owned by an incumbent or alternative operators in the telecommunication market and, therefore, are not considered to be telecommunication operators. It is important to note that such companies are often not included in any telecommunication investment related data due to their nature and the fact that they are not seen as telecommunication service providers (OECD, 2007/6).

### **1.4.1. General trends in the telecommunication investments – historical overview**

For the past years broadband has become the dominant fixed access method in all the countries of the Northern Sea Region. According to the OECD communications outlook for 2009, it was about 40 per cent of dial up connections in 2005, but already in 2007 that percentage had fallen to 10. In 2008 DSL remained the leading broadband technology, with its 60 per cent of all broadband subscriptions. Ever since (in the late 1990s) most countries in OECD opened up their telecommunication markets to full competition and focused on developing

broadband services, governments have been adopting policies on broadband development. To date, most of the service competition is based on local loop unbundling (LLU) (OECD, 2007/6).

By early 2000s in a lot of European countries LLU framework and the development of broadband led to development of new services and further expansion of broadband-based markets. In addition, broadband increased amount of Internet Service Provider on the markets who provided both Internet/Broadband access and voice/video services. Additional to the competition promotion government were working on promotion of innovation and broadband based investments, therefore, were regarded as “an important policy issue for some regulators” (OECD, 2007/6, p.10). Such “ladder of investments” supported by regulatory decisions (such as, for example, LLU), was creating competition in the markets and allowed new entrants to rapidly create a customer base and generate immediate revenues. This competition by private telecommunication sector, it had been argued, led to a stimulation of further investment into broadband technologies because new entrants were moving up their investment ladder to further investments in their own facilities and competition in the local loop<sup>39</sup>.

As stated by OECD specialists<sup>40</sup>, telecommunication investment has been sensitive to changes in economic climate over past 20 years. Trends of investments changes between telecommunication investment and GDP mimic each other with a 60 percent correlation - a 1 per cent change in GDP corresponds roughly to an 8 per cent change in telecommunication investment. Data provided in Table.6 includes the data-per-capita basis showing public sector investment into the telecommunication sector – including broadband-based investments – in 1999-2005. Among the countries in the Northern Sea Region public sectors largest investments, on average for the given period of time, are made by the UK, the Netherlands and Denmark. It is noticeable that amounts of the investment differ significantly during the years and it does not have any pattern unless looked at with changes in GDP and economical situations in the countries as a whole.

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<sup>39</sup> (OECD, 2007/6)

<sup>40</sup> (OECD, 2009/1)

Table 6<sup>41</sup>: Public telecommunication investment, per capita.

	1999	2000	2001	2002	2003	2004	2005
<b>Belgium</b>	72,93	92,93	57,52	72,98	85,83	96,58	113,34
<b>Denmark</b>	185,22	209,01	247,16	180,4	157,85	176,8	209,8
<b>Germany</b>	101,09	110,51	124,7	81,21	74,89	85,3	98,98
<b>Netherlands</b>	658,98	199,37	166,51	96,87	112,27	118,57	82,13
<b>Norway</b>	121,17	128,59	132,31	155,82	114,76	223,09	247,11
<b>Sweden</b>	114,42	184,49	192,66	159,43	162,08	175,35	130,93
<b>UK</b>	218,11	239,81	239,53	171,69	183,58	199,94	219,29

Historically, not the public, but the private sector investments totally dominated the market. Telecommunication operators were the most significant investors in the telecommunications sector. For example, in 2005 such investments accounted for 73 per cent of the overall sector's investment (OECD, 2007/6). Nevertheless, in 2000-2002 the effect of the "dot-com bubble"<sup>42</sup> may have caused reduction in telecommunication investment by the private sector. At this point it is important to note that there are only few studies that dealt with correlations between investment and unbundled local loops (Baake, 2006; Total Telecom, 2007) and none of them seem to take into account the impact of the "dot-com bubble" effect on investment and find any correlation between the downturn of investment and the "dot-com bubble". Nevertheless, almost all OECD countries, including some countries in the Northern Sea Region were affected by the "dot-com bubble".

The data on investments by fixed operators is represented in figures 8 to 14. The right-hand graphic shows year-to-year data where bolded line shows trend line in investment and dotted line shows trend in growth of fixed network investments. The left-hand graphic shows total telecommunication investment by incumbents (light blue bar) and capital expenditure for the fixed network by incumbents (dark blue bar).

<sup>41</sup> (OECD, 2007) Table 4.17: Public telecommunication investment, per capita.

<sup>42</sup> "Dot-com bubble" is often referred in literature as a period (roughly between 1998 and 2000) "during which a large number of telecommunication operators speculated in Internet related activities" (OECD, 2007/6, p.4)

Figure 8<sup>43</sup>: Investment by increment fixed operators in Belgium.

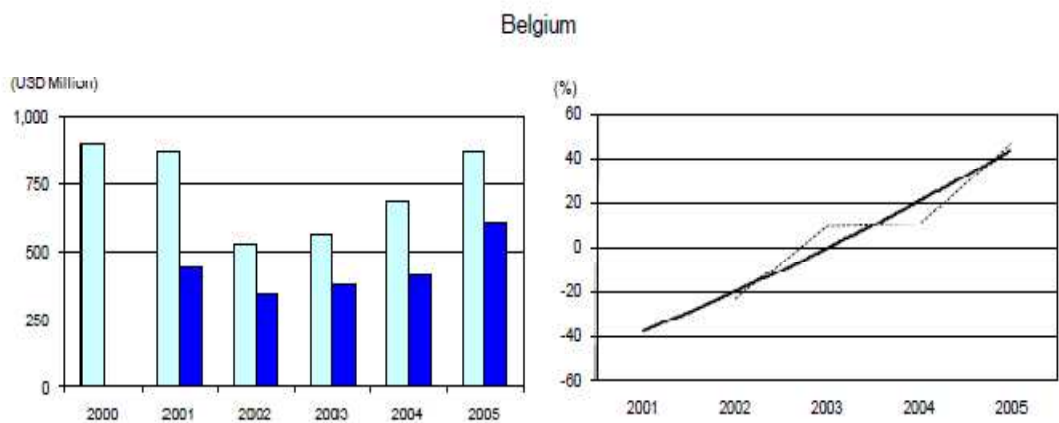


Figure 9: Investment by increment fixed operators in Denmark.

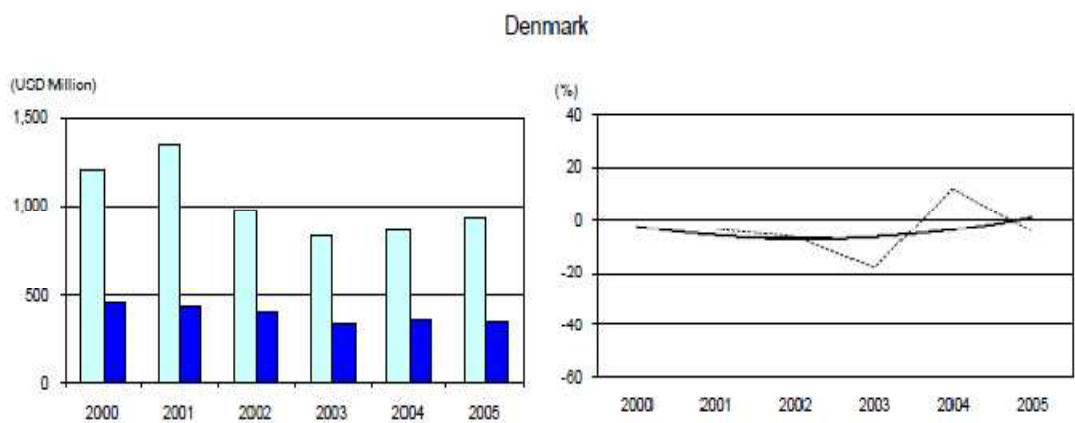
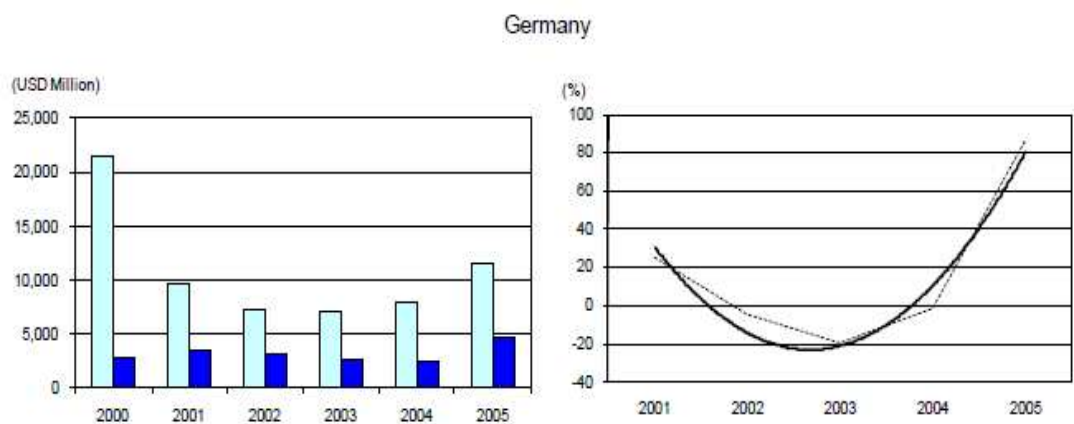


Figure 10: Investment by increment fixed operators in Germany.



<sup>43</sup> Figures from 8 to 14 are taken from OECD (2007/6): Figure 12 Investments by incumbent fixed operators in OECD countries

Figure 11: Investment by increment fixed operators in the Netherlands.

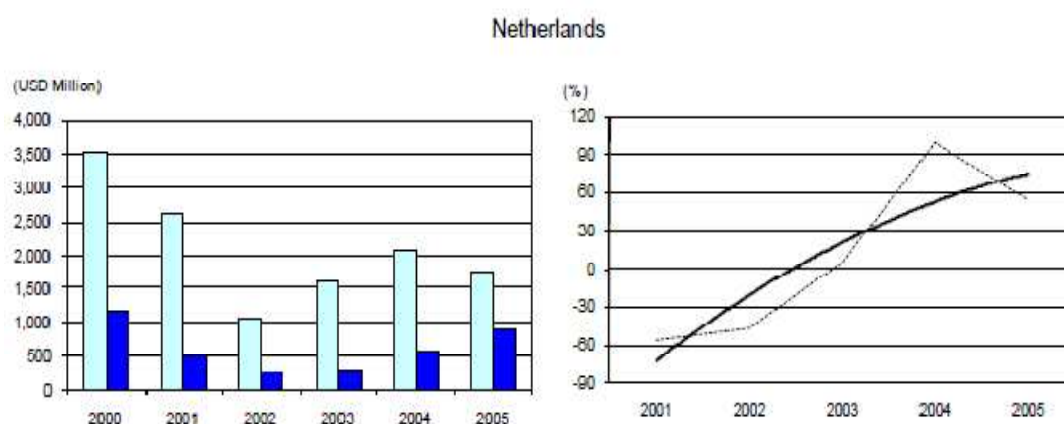


Figure 12: Investment by increment fixed operators in Norway.

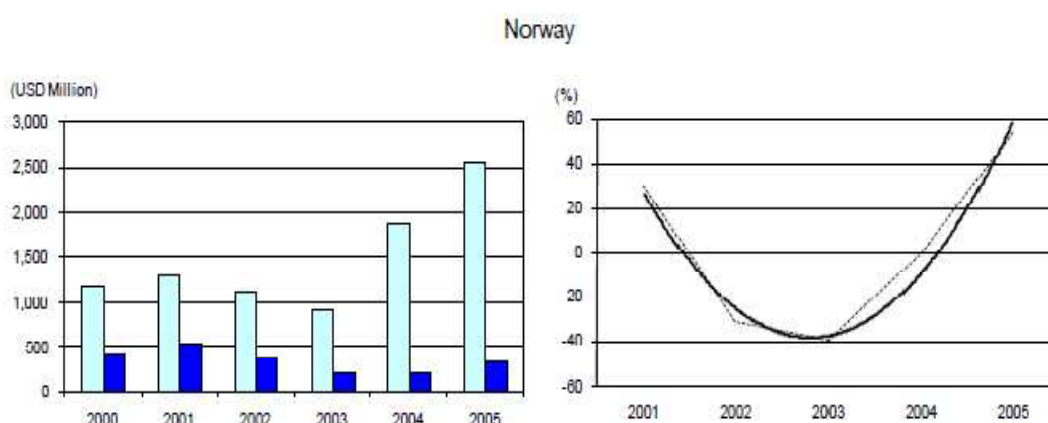
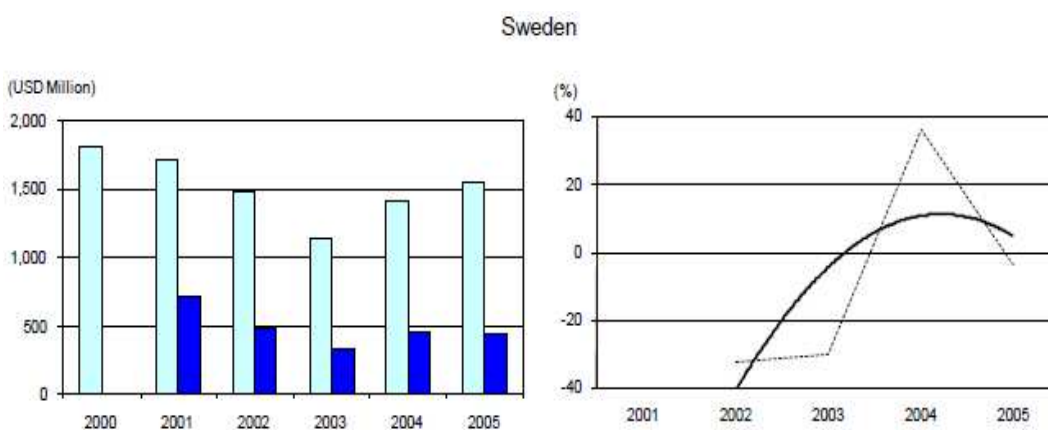
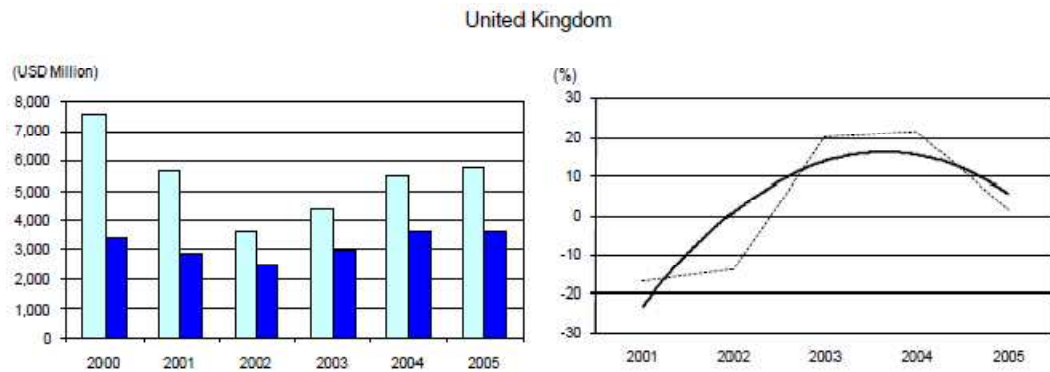


Figure 13: Investment by increment fixed operators in Sweden.



Note: Data for the fixed network business for 2000 are not available.

Figure 14: Investment by increment fixed operators in the UK.



The data from the graphs show, in most cases, a rather similar picture: the growth of investments after the end of the “dot-com bubble” in 2002. In some cases the situation changes in 2005 and the data shows a decline in the investment.

When it comes to investment in fibre, not much data is available for the countries in the North Sea Region and there is no data available on the proportion between investments in fibre to the total fixed network investment by incumbent operators. Nevertheless, it looks like these two technologies are seen as “worthy of investment” by many telecommunication operators. Investment in fibre in the local loop and wireless broadband technologies are expected to continue its growth in future<sup>44</sup>.

#### 1.4.2. Financial crisis impact on the broadband-based investments

The current financial crisis poses some significant challenges to both private and public broadband based investments: the further development of broadband infrastructure and different R&D projects, arguably, slowed down. Yet under EU Cohesion Policy programs there is a foreseeable use of 15, 2 billion euro for

<sup>44</sup> (OECD, 2007/6)

investment in ICT in the period 2007-2013. As broadly discussed in the media the financial crisis led to a significant fall in consumer and business confidence, as well as overall global economic activity. The economic outlook still remains uncertain. According to the Garther (2009), the economic crisis is having a major impact on the ICT sector in Europe. In Western Europe total end-user spending on ICT is expected to fall 8 per cent in 2009 and remain flat until 2011, while spending on ICT are expected to grow again (COM, 2009). Nevertheless, governments of all EU countries and Norway recognized the crucial role of ICT for economic recovery. The governments' investments in broadband is seen "as a way to stimulate demand in recession-hit countries while also expanding the long-run productivity capacity of economy", as well as "to promote the Internet Economy and stimulate sustainable economic growth and prosperity by means of policy and regulatory environments that support innovation, investment and competition in the ICT sector" (OECD (2009/2), p.7). Therefore, investment in high speed broadband network is included by many countries as a part of economic stimulus package.

According to the European Recovery plan, the sum that governments are prepared to invest in broadband is foreseen to be up to 1, 02 billion euro from EU funds (COM, 2009). The goal of the broadband network investments for many countries is full (100 per cent) coverage of broadband internet between 2010 and 2013. For example, Germany is planning to invest up to 150 million EURO, as a part of its stimulus package, on broadband networks. Their goal is to give high-speed internet access to  $\frac{3}{4}$  of the population by 2014 and all the population by 2018. The understanding behind such investments is that broadband network should be promoted with the aim of providing access to poorly served and high-cost areas where the market cannot deliver (COM, 2009). Besides, direct investment in broadband, stimulus packages of the countries includes some indirect investments that impacts ITC deployment. For example, Norway is investing around 100 million NOK in promotion of its digital government services, video-conferencing, electronic signature and electronic prescriptions in the health system<sup>45</sup>.

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<sup>45</sup> (OECD, 2009)



### **1.4.3. Public Investments**

In the current paper the term “public investment” refers to “productive” public spending: “governments expenditure that can be included in the private production function and thus is the only kind of spending which has an effect on long-term economic output” (OECD, 2009, p.9). Commonly, public telecommunication investments are considered to be “productive” because they affect the long-run aggregate supply and provide positive externalities. They are generally divided into two categories: backhaul network and last kilometre connectivity – they target extending connections to un-served or underserved areas and upgrading existing connections with higher capacity<sup>46</sup>.

#### ***1.4.3.1. Role of the Governments in broadband based investments***

Government plays a central role in maximising the economic and social benefits of broadband, as noted in the previous chapter of the paper. It appears that the role of the governments is multiple when it comes to creating such benefits, for example, governments can help in creation of conditions in the market for a favourable investment or/and innovation climate, or come up with regulations that would stimulate the market for the competition between infrastructure providers, they can also take a role of a customer for broadband providers and conduct important for the market research<sup>47</sup>. Therefore, the role of the governments is very important and very different. This is the reason why OECD authorities came up with the initiative of defining the concrete areas of initiatives for governments: OECD had pointed out that central and local authorities have three different roles when it comes to broadband infrastructure building<sup>48</sup>:

- 1) The role of a Stimulator – removing all the barriers that may affect effectiveness of infrastructure building and amount of investments by other actors.

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<sup>46</sup> (OECD, 2009/1)

<sup>47</sup> (OECD, 2007/3)

<sup>48</sup> (OECD, 2007/4)

- 2) The role of a Producer – governments are acting as an investor into new networks;
- 3) The role of a Regulator – ensuring that the laws and rules are designed to support competitiveness of marketplace.

All three roles of the governments are equally important and the sphere of interests are overlapping each other, but generally, governments are working on following: removing barriers to entry into the telecommunications markets and invest in it; facilitating a cost effective roll out; ensuring development of new services and networks, as well as new markets itself; providing regulatory certainty for networks and services in achieving competitive marketplace. In this paper the primarily focus is on the role of governments as a Producer/Investor. Nevertheless, in the context of the paper the role of the governments as Regulators will also be mentioned.

As far as OECD's recommendations go, it is very important for governments to invest actively in new networks, but, as a general rule, intervention in the market should be as minimal as possible. On the other hand, policy makers are highly advised by the other OECD specialists (OECD, 2009/2) to continue promoting private sector investment and competition, network technologies and perspective topologies, at the same time reducing the need for public funds to be directed towards broadband projects.

#### ***1.4.3.2. Stimulation of broadband-based investments by public sector***

New technology deployment causes new regulatory paradigms to emerge. Demand for new applications and services arise every year, including public services for the population, as well as new technologies such as fibre network. At the same time, direct public intervention in telecommunication markets is unavoidable due to lack of private investment in rural and remote areas and, as noted above, affects the market and sometimes determines the success or failure of a technology on the market. Thus, even though regulations are required for

public sector to intervene and settle market failure, the same regulations may slow down the pace investment in broadband through a misplaced intervention (Pietrunni, 2008). A situation like that and its possible, negative outcomes forces the governments to balance their actions and investment initiatives<sup>49</sup> and consider the incentives for telecommunication investors to actually invest in the infrastructure<sup>50</sup>. Therefore, in addition to minimal intervention in the market and its regulation, governments are advised to make sure that their investment initiative is going to be warranted. A few main questions need to be answered before the investment decision is to be made: the question about effect of investments on the public welfare, the question about a possible market failure and, finally, the question of whether the benefits of government intervention outweigh the costs (OECD, 2008).

The approach taken by governments alters the basic tenets of a cost-benefit analysis that takes into account all potential costs and risks over the long run. This analysis is a useful technique that accurately measures cost and benefits in monetary form and compares negative and positive effect of different project proposals (Olson, 2004). Assessment of overall costs and benefits requires taking into account all relevant aspects of sustainable development. In the case of public broadband-based investment, cost-benefit analysis can be viewed from the perspective of *society*. For broadband infrastructure projects the cost-benefit analysis often properly accounts for such elements as, for example, environmental and social repercussions. As mentioned earlier, governments included investment in further development of broadband in their stimulus packages. The reason for it is – looking from cost-benefit analysis perspective – the ability of broadband connectivity to deliver not only strong direct effects (demand side) by employing people to literally “roll out” the network, but also indirect effects (on the supply side)<sup>51</sup>. The examples of indirect effect may be social in nature, efficiency of investment or consumer surplus. Thus, allocation of funds by governments involves consideration of many factors including both social and economic objectives.

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<sup>49</sup> (OECD, 2007/4)

<sup>50</sup> (OECD, 2007/3)

<sup>51</sup> (OECD, 2009/1)

To support this point of view one can look at one of the central documents that highlight importance of several factors for governments considering investing in telecommunication sector - “Recommendation of OECD Council on Broadband Development”. The factors that highlighted there are: improvement of connectivity, increscent of competition, stimulation of innovation and growth, and increscent of social benefit<sup>52</sup>. Further on, it is recommended by the OECD that government investment should address and strike a balance of these four elements. Improvements in these areas are seemed to be the central concerns when it comes to measuring possible outcome of the broadband based investments for public sector.

#### ***1.4.3.3. Social value of public investment***

Economists argue, as noted above, that social impact of broadband such as improved connectivity for the citizens, increased competition on the market and few other direct benefits are not the only ones that need to be considered by the public sector when deciding on a broadband project (OECD, 2009/2). The indirect effects are just as important to consider. For example, investments that are funding network connectivity in rural areas have less impact on innovation and productivity growth compare to the metropolitan areas with large amounts of people and companies, but these investments takes strong social objectives into account. “The remote areas with new connectivity will see significant new social benefit and inclusion. There will also be beneficial network externalities if all citizens have access to broadband connectivity” (OECD, 2009/1, p.34). Indeed, as it is mentioned above, people in remote areas would benefit the most when it comes to accessing online governmental services, their well-being as on-line consumers, benefits to local communities and so on.

Another example of indirect effects of investment in building broadband networks is different spill-over effects from such investments. For example, as noted by OECD specialists, “Widespread, high-speed network connectivity could have a significant impact on sectors such as health, education, transportation and

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<sup>52</sup> (OECD, 2004a)

electricity by improving efficiency and laying a foundation for innovation across these as well as all other sectors of the economy”<sup>53</sup>. It is commonly accepted that broadband is needed as complementary investment in other infrastructures<sup>54</sup>. The other spill-over effects are also mentioned in the previous chapter. Examples of such spill-over effect from infrastructures could be buildings, some transportation infrastructure as roads and transportation systems, electricity grids – things that would save energy or improve safety or adapt to new ideas for other sectors. In this regard, the question of actual size of such spill-over effects is important to the governments.

#### ***1.4.3.4. Innovation and growth as a function of broadband based investments by public sector***

Broadband plays a central role in competitiveness of businesses in the global economy, as discussed in the previous chapter, and is an important platform for innovation and growth in different countries. Indirectly, the new investments in broadband infrastructure can also cause improvement of innovation and growth too, due to the fact that these investments are upgrading the infrastructure to support new services, benefit more households and businesses, and create a greater balance between last-kilometre capacity and backhaul (OECD, 2009/1).

As pointed out by some empirical studies, level of infrastructure determines the relationships between infrastructure and growth (e.g. due to threshold effects in network externalities) and that infrastructural investments impact on growth is very country-specific (due to the level, allocation and quality of investment in different countries): “There is evidence that [threshold] effects are larger when the broad measure of telecommunication and energy provision reveals lower levels of infrastructure” (ECO, 2009, p.17). Therefore, infrastructure can be seen as somewhat of an “engine for development”: arguably, the more network infrastructure is available the larger would be its impact on economic growth in a particular area (a region or a country). In addition to this, the benefits from receiving public sector investment are both long-term and short-

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<sup>53</sup> (OECD, 2009/2), p.13.

<sup>54</sup> (OECD, 2009/1)

term. As an example, in addition to the direct effects of the infrastructure building in a particular area (such as employment, social benefits to the users and so on), it also has strong “marginal” impacts on productivity and overall economic growth of that area (platform for research, science co-operation, new innovative services and applications, new businesses and others) (OECD, 2009/1). It is reasonable to note at this point that in some cases the public sector may want to consider collaboration with private companies when it comes to broadband-based investments. Such “public-private sector partnerships” are not very common in the telecommunication sector. Nevertheless, they “have been successful in a number of cases and allow government investment to be coupled with technological and market experience” of the private actors (OECD, 2009/1, p.20). More detailed overview over impacts of broadband on productivity and growth is presented earlier in the paper.

#### **1.4.4. Private sector investments**

In the current part of the chapter the main focus is on the investment into broadband infrastructure made by the private sector, such as privately owned telecommunication operators (both incumbents and new entrants), excluding data from alternative fixed operators and ISPs.

##### ***1.4.4.1. Criteria for investment***

It has been argued that investment is a function of returns. For example, “private firms look at the potential returns of any investment under consideration and only undertake the investment if the market value of the investment exceed costs” (OECD, 2009/2, p.12). This is one of the main “rules” or “characteristics” of how privately owned and some public companies allocate their capital in the market. The private sector is interested in receiving as high return on investment as possible. They would not want to invest if, among the other factors, the

investment may not pay off because of the high up-front cost of building it or it is too risky for the company and it will not receive reasonable returns on it. Additionally, as a result of some long-term risks, operators hesitate to build the networks in rural areas, the areas where the potential returns are low. “They stop extending networks as soon as they reach areas where their private return on investment is not high enough to cover build-out cost”, as noted by OECD specialists (OECD, 2009/2, p. 12). Looking at it from this point of view it is obvious that large cities and other high-density population areas will typically be the least expensive places to build their network and, for example, to cover it with their wireless signals. Therefore, the return on investment naturally is favorable in metropolitan areas and rural areas are usually not cost effective for operators (OECD, 2008b).

No social benefits or spill-over effects are usually included in the estimation of market value of the investment, unless, of course, such effects can be monetised by the operators (OECD, 2009/2). For example, the literature points out at the situations when the total potential benefits of installing a new network can outweigh its cost but it has not been built by private operators simply because they couldn’t recoup their initial investment (OECD, 2009/2). This form of market “imperfection” potentially leads to non-optimal provisioning of services (OECD, 2009/1; Farrell, 2006). In some cases, such potential benefits are the social impacts of broadband connectivity. It could be potentially larger than the return on investment, but the private operators are not investing because of the inability to internalise it. Clearly, there is no consideration for society and people possibly benefiting from it. Again, the only one who it seems takes the social responsibility approach, for example, broadband for all, is the public sector.

This appears to sit ill-at-ease with the great movement within business known as CSR whose aim is to replace a moral language in business. A general definition for CSR implies that it is a concept whereby enterprises bring together social and environmental considerations into their business operations, i.e. CSR deals specifically with area of private sector responsibility that extends beyond value creation – “responsibility towards people, society and the environment that are effected by their activities”<sup>55</sup>. More broadly, as a concept and practice CSR

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<sup>55</sup> (NMFA, 2009), p.7.

has been applied and adapted to “a wide variety of business contexts, crisscrossing economic, political, cultural and social boundaries” (Fukukawa, 2009. p. 18). However, it must be noted there is no globally accepted definition for CSR, neither is there a set of commonly accepted themes that the concept should embrace. Whatever the position, the UNCTAD refers to CSR as a concept still evolving, both along with society and as a function of society’s expectation.

With some respect for CRS, some “efforts” had been made by telecommunication operators who had invested in broadband connectivity which had some social benefits, but in most cases only if these benefits could be monetized by the operator (e.g. charging user for second-party services (OECD, 2006); charging additional fees to mobile subscribers when those were using their subscription’s “unlimited” data connection on a computer tethered or connected to the handset with the subscription (OECD, 2009/2). In other words, even though telecommunication operators are investing in the broadband project that gives some social benefit they try their hardest to create highest value possible from such projects and recover the high fixed costs of building it by extracting payments for certain spillover effects. So, all-in-all, it could be argued that at least some of CSR intentions seems to be a lot of fine word, however, the main interest goes back to the market value creation.

As it is commonly known, every investment has risks, systematic<sup>56</sup> and non-systematic<sup>57</sup>, that needs to be considered by the investor. The situation is not different in the telecommunication sector where one can find situations when the investment decisions of the communication companies can not only be based on the rate of return on investment and cost of capital, but the large fixed costs or irreversibility of investment decisions<sup>58</sup> (this is very relevant to the new fibre network infrastructure investments) are causing operators to consider all specific risks related to the investment. Then, additionally to the investment determinants companies are considering the regulation on the market or a regulatory risk, cost of infrastructure and market demand (Muselaers N., 2010).

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<sup>56</sup> A risk caused by macroeconomic events and affects all the businesses throughout economy. Systematic risk cannot be diversified anyway by investors (Muselaers N., 2010).

<sup>57</sup> A risk that is specific to a business or an industry. It affects expected value of investment. Can be diversified by an investor by holding a large diversified portfolio (Muselaers N., 2010)

<sup>58</sup> (ECO, 2009)



The brief description of the infrastructure cost and market demand (penetration rates) has been stated earlier in this paper, whereas the regulatory risk and its effects are presented in this chapter. The question of regulation is central to the question of “investment drivers”. According to the relevant theoretical literature and some case studies (e.g., Pindyck, 2007; Cave, 2006; Waverman, 2007; Cadman, 2007), there is a direct relationship between investment initiatives and regulations. A study conducted by Bouckaert, Van Dijk and Verboven in 2008 (Bouckaert J., 2008) shows that a difference in regulatory approach taken by different countries affects the investment initiatives and its final outcome. For instance, “this is consistent with the view that service-based competition does not provide sufficient investment incentives to new entrants and discourages investment of the incumbent operator” (Bouckaert J., 2008, p. 2). Some authors argue that the access regulation (low access prices and access at cost based charges) negatively affects ROI and investment initiatives of the operators (Pindyck, 2007; Waverman, 2007). Others argue that the access regulation (pricing structure implementing ladder of investment) increases the investment initiatives (e.g., Cave, 2006). The study conducted by the European association of competitive telecommunications providers’ shows a correlation between telecommunication infrastructure investments and “quality” of regulatory regime in European Countries (Cadman, 2007).

Regulatory risk can be simply described as a risk caused by a regulating body (government), when it intervenes in the market in a manner unforeseen by the operators or in the form of deployment of new or changing existing regulatory requirement/legal frameworks in the market (that may affect operator’s profitability or competition in the market and so on). It is especially important for the operators considering investing in the fibre networks. The reason for that is, as nicely put by the analytics from OPAK, that “investors are currently facing decisions to make irreversible investments of a major size into a sunk infrastructure in a situation with considerable uncertainty” (Muselaers N., 2010), p. 6). It is very important for operators to estimate how exactly the regulation can affect their investments, depending on the regulatory regime existing in that particular market. For example, government may set specific user costs or final prices of the broadband service for the operators, depending on the competition in the market and whether the network provider is vertically integrated (ECO,2009).

#### ***1.4.4.2. Long-term and short-term investments***

Generally, operators in OECD countries are investing significantly in new and high-speed broadband networks that are capable of transmitting an audio-visual experience that exceeds former capabilities, diffusing that experience over a range of various devices and networks (OECD, 2009). Nevertheless, the debates about investing in the Next Generation Broadband Access (NGA) continue, bringing different points about costs and benefits of investing in these technologies for the operators. Clearly, costs of building new infrastructure are high and benefits are yet uncertain. Some potential investors argue that while the benefits for companies are uncertain it is yet early to be talking about investing in the NGA. Still, others are saying that “NGA is inevitable” and countries and companies should not “fall future behind” (Parliamentary Office of Science and Technology - Postnote, April 2008, p.3) and that “Investments in NGA networks are desirable development which will enable the provision of innovative and better broadband services” (Muselaers N., 2010, p. 4). It is important to note at that point that fibre-based technologies has matured in recent years and, currently, NGAs (fibres) are capable of providing much faster broadband than other technologies. For example, such countries as the Netherlands and Sweden, as noted above, are deploying NGAs. Sweden already has half a million fibre to the home connections. Other countries, as the UK are still arguing whether to invest in fibre infrastructure outside of new-build sites or not. Private telecommunication operators are aware that the demand on such technologies currently is limited but potentially, deployed once, the technology would not need to be replaced for at least 25 years and that can give a high return on investment after all<sup>59</sup>.

As pointed out by the researchers at OECD’s Working Party on Communication infrastructures and Services Policy, when it comes to investment decisions, whether in fibre or cable technologies, one should be aware that incumbents and new entrants have different investment ratios, outcome desires

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<sup>59</sup> (Parliamentary Office of Science and Technology, 2008)

and strategies (long-term or short-term investments)<sup>60</sup>. Therefore, the main drivers for the investment are likely to be different as well. Shortly, incumbent's investment decisions can be influenced, additionally to return on investment, by other factors such as the position it has in infrastructure, the interests of its shareholders (employees/management) and their values. Generally, they do not have large amounts of available for investment cash-flow due to their business models based on fixed monthly fees from end-users, but they do have large ownership capital and capabilities to generate funds to finance their investments (OECD, 2007/4). There are different strategies they use to develop their networks. For example, upgrading their current networks to ADSL2+ (British Telecom, UK), or upgrading their networks to VDSL2 (Belgacom, Belgium; Deutsche Telekom, Germany), or building all-fibre/hybrid-fibre networks (Bredbandbolaget, Sweden; Reggefiber, the Netherlands). The first two mentioned strategies can be seen as short-term ones, where as the third one is a long-term strategy. On the other hand, new entrants are interested in gaining first mover advantage, especially when it comes to deploying fibre technologies; therefore they are interested in moving up the ladder of investment and create welfare benefits for the region they are investing in (OECD, 2007/4). At the same time, very often they are disadvantaged, in comparison to the incumbents, due to lack or limited access to existing civil works or self available investment capital<sup>61</sup>.

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<sup>60</sup> (OECD, 2007/4)

<sup>61</sup> (Muselaers N., 2010)

## 2. Research methodology

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### 2.1. Introduction

As the inconclusiveness of relationship between the investment initiatives and the drivers motivates the current study, the focus of the researcher was on the variety of both theoretical and empirical research on this subject. The main method used in the master thesis is desk-based review and synthesis of information from existing documents, particularly previous reports and reviews. This is supplemented by personal interviews with representatives from Norwegian public sector. More specifically, the reviewing started with identifying all the relevant studies that were conducted by OECD specialists on investment in telecommunication sector in the Northern Sea Region in the past years; the researcher then sat about identifying the other relevant empirical studies on the same topic, and finally the interviews with three relevant persons were conducted. Furthermore, the drawbacks of the previous studies were examined and the tentative recommendations for the future research were given. Due to the nature of the current research – an extended literature review or a desk-based literature review – the research methodology is mainly concerned with literature review and analysis method.

### 2.2. Literature review and analysis method

The main challenge facing the researcher is to pick the most relevant and valuable publications and articles directly related to the topic of the current thesis, as well as to correctly evaluate and criticize the reviewed literature. More specifically, this challenge includes two main aspects: identification of relevant and valuable publications, and the problem of obtaining them (Janskovicz, 2002). Since the

nature of the research is an investigation or, in another words, a historical research in a very new and, therefore, poorly research area as Broadband and Investment in Broadband the available theoretical and empirical research literature is very limited and difficult to obtain. Due to this obstacle, the identification of core books and texts with regards to the research topic failed. One of the few options that were left to the researcher is to use available research studies and relevant statistical information published on the Web – conducted mostly by the OECD researchers and some studies by other authors in the period between late 1990s and 2010. Thus, the following approaches have been taken: through using such key words as, for example, Broadband investments, Telecommunication investments, Broadband deployment (and many more) in the following Web pages: [www.google.no](http://www.google.no), [www.oecd.org](http://www.oecd.org), [www.ec.europa.eu/eurostat](http://www.ec.europa.eu/eurostat) it was possible to locate some broadband related literature.

Out of all found articles, studies, statistics, books and academic researches it was fairly difficult to identify relevant studies and statistics that could be used for the current thesis. It must be noted, though, that after identifying just a few relevant studies via described technique, the studies itself were of help in locating other relevant sources by having a reference list and bibliographies that were used by the researcher for further identification of relevant literature. Additionally to the described procedure one of the interviewees provided very valuable research on Norwegian Broadband policy and gave very valuable tips where to look for more relevant information concerning Broadband deployment in Norway.

It is important to note that accuracy of acquired material is one of the main factors that should be taken in account before the information can be seen as relevant and usable. The literature for the current paper is obtained in a very respectable and known sources such as, to name a few, European Statistics Database – Eurostat, annual reports and white papers published by Commission of the European communities, studies conducted on behalf of the European Commission (DG Information Society and Media), research papers, reports and outlooks conducted and treated by scientists at the Organization for Economic Co-operation and Development (OECD). Because the core literature is taken from a public body the current study is following the direction of research proposed by the OECD scientists. Therefore, the main focus is on the historical research – investigation into background of broadband based investments - viewed from

predominantly public sector perspective blended with empirical studies conducted by the private sector or independent researches.

All the located literature was carefully reviewed and papers that clearly were referring to some other aspect than broadband based investments were removed. The remaining studies and articles were then reviewed in detail and the most relevant and usable papers were saved and looked at as a literature appropriate to review for the research aim of the current master thesis.

### **2.3. Survey Method**

After all the relevant literature was analyzed the researcher of the current paper decided to collect additional data by using the survey method – one of the most important data collection methods in the business studies, which is used extensively to collect information on numerous subjects of research (Frankfort-Nachimas, 2006). It had been decided to conduct a few interviews with employees of an appropriate governmental body in Norway – one of the countries in the Northern Sea Region. This additional data collection methodology was chosen in order to be able to verify and support findings made from the desk-based review of the relevant literature. The data was collected directly from the interviewees during personal interviews. Out of all types of interviews the Personal Interview survey method had been chosen due to its advantages, namely, flexibility in the questioning process, control of the interview situation, high response rate and possibility to obtain fuller information (Frankfort-Nachimas, 2006). The questions for the interviews were designed to identify the relationship between the investment and broadband deployment and were based on the observations made during the analysis of reviewed literature. These questions were read to the interviewees by the researcher. All the data was recorded, by permission of the interviewees, on a Dictaphone and then transcribed. Transcribed data were then saved and used for the analysis.

The full description of the data collection through interviews is given as the following:

- (a) Participants and setting.** The sample of interviewees was selected by recommendation of the heads of key governmental broadband policy related establishments in Oslo, Norway. All three persons are employees in different Norwegian Ministries that have responsibility in allocation of broadband funds in Norway. Out of three interviewees selected for the current study, all three were suitable for participation. These three participants are from different employment positions and all worked for Norwegian government in the area of broadband based investments and thus presumed well versed on the subject of broadband based investments in Norway and other EEA/OECD countries. The interviewees were Halvor Ødegård, senior adviser at Department of ICT and Public Sector Reform in The Ministry of Government Administration, Reform and Church Affairs, Norway; Hans Einar Nerhus, senior adviser at the Ministry of Transport and Communications, Norway; Eivind Lorentzen, senior adviser at the Ministry of Trade and Industry, Norway. It was acknowledged by the interviewees that all the data obtained through the personal interviews with them will be used for the purpose of conducting a research for a master thesis.
- (b) Procedure.** Firstly, an e-mail was sent to randomly selected adviser from the Ministry of Trade and Industry Mr. Eivind Lorentzen. The e-mail included name of the researcher and that the researcher was from UiS who was writing final-year thesis in the area of Broadband-based investment. It was also included that the researcher is looking at such investment drivers of Broadband from the perspective of both the private and the public sector and I would thus very much appreciate a short interview with the appropriate figure within the selected department. The potential interviewee agreed on a short interview and directed the researcher toward his three colleagues from different departments who had responsibility for and funding of broadband policy in Norway. Three more e-mails of the same consistence were sent to the three recommended persons and all three of them agreed to give a short interview.
- (c) Data collection.** This paper employed a semi-structured interview technique (Ghauri, 2005) – where the topic of the interview, discussed issues, sample size, people suitable for an interview and the asked questions were determined beforehand. Interviews were conducted and recorded using a

Dictaphone, as mentioned - the purpose being that it is a reliable way of recording interviews without losing vital content. The recorded information was then synthesised. Interviewees were asked three questions that are directly related to the nature of the current investigation. The first question was: *What would you say that the main drivers for broadband-based investments are?* The second question was: *Do you think the main drivers (that you mentioned answering the first question) are likely to change in future broadband-based investments?* The third question was: *Do you think that the reasons – the drivers – for investment differ from the private sector to the public sector? How do they differ? Why do they differ?* The interviews took 12 minutes on average.

**(d) Limitations of the obtained data.** One of the limits or disadvantages of using personal interview method is interviewer's personal influence and bias (Frankfort-Nachimas, 2006). It must be noted that the interviewer remained as objective as possible during the interviewing process and try to avoid communicating personal issues, the possibility of interview bias cannot be totally excluded. The data collected from three specialists from Norwegian government are fairly limited and best suitable for a descriptive analysis. Also, even though the data are collected from the representatives from the country that is included in the Northern Sea Region of Europe, the fact that Norway is not a part of European Union and therefore does not get the same financial treatment as the rest of the countries in the mentioned region makes the data fully applicable in the Norwegian realities. Nevertheless, Norway is willingly following the directives of the EU on the broadband strategy and the main goals are the same as with the rest of the countries in the region, therefore the data can be applicable to be generalized for the rest of the countries in the region. There are several considerations that may need to be taken into the account when working with the data. First of all, in one of the cases the meaning of "broadband based investments" needed to be explained to the interviewee because it was not obvious what kind of investment the researcher mean – whether it was referred to public funds used to co-finance broadband roll out in rural areas or was it referred refer to the public sector as a broadband customer, i.e. when the public sector subscribes to broadband services. It was made clear to the interviewee that the researcher referred to



broadband based investment as the funds that public and private sector invests into broadband infrastructure.

## 3. Discussion and Result

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### 3.1. Introduction

The following chapter presents the discussion and results of the findings of the current paper. The current discussion consists of two separate subcategories: discussion of the observed data obtained through the literature review analysis and discussion of the observed data through the interviews. The reason behind the separation of the discussed data is done to simplify the structure, make it clear and reader-friendly. The main findings are presented in the different sub-categories.

In the lights of the aim of the current study – to investigate the background of investments in broadband by the private and public sectors in the Northern Sea Region and, based on the analysed information, to find out what the main drivers for these investments are – a number of authors in a not-so-broad literature on the subject have attempted to identify issues like the ones that the current paper investigates (Pietrunti, 2008; OECD, 2007/6; OECD, 2009/1; OECD, 2009/2). Those studies, as well as other related works conducted by different governmental research groups and independent scientists, are discussed in the current paper. Additionally to that, the current chapter also contains discussion of the empirical research that had been conducted specifically for the current study. The result of that empirical research showed that respondents seemed convergent regarding the main drivers for the public and private investments. However, the likeness of the responses may be due individuals' academic and employment background and how these characterise opinions. Nevertheless, it is clearly noticeable that it appears to be a convergence between interviewees recorded responses and the reviewed literature, when it comes to outlining the drivers of broadband investments.

### **3.2. The discussion of the reviewed literature**

Due to the nature of broadband and its role in the global world it is very important to acknowledge the main drivers for the infrastructure investment in even faster broadband technologies by investigating its historical path. For Europeans, northern Americans and Asians, as well as other nations, the importance of broadband accessibility and its ability to deliver both businesses and individuals what they require is very high. Nevertheless, many do not know what actually makes governments and private sector willing to invest into building new or constantly upgrading existing infrastructure system. Therefore, the main concern of the current research was to review literature in order to investigate the background behind the investments made by the private and public sectors in the Northern Sea Region to analyze the existing data and find out what it is that actually drives those investments.

The investigation conducted in the current study revealed that the topic of broadband capacity and availability is central for many businesses and individuals in the countries of the Northern Sea Region. So far, there are still doubts over benefits and the place of broadband in modern society, and this paper's aim is to bring together and combine all the available information and analyze the very main drivers of broadband-based investment in the Northern Sea Region. Based on the researched literature it becomes obvious that from the social-economic profitability point of view governments should invest significantly towards the building of broadband infrastructure for its citizens. Such new investments will bring in social objectives by benefiting citizens and businesses which are located in rural and remote areas. However, an uglier side to this discourse is that "left without the necessary communication infrastructure these regions will be disadvantaged in participating in the economic and social development that will take place in areas that have superior connectivity" (OECD, 2009/1, p.6).

So far, as understood from evaluation of the body of literature on broadband investment, one can clearly identify five of the very main reasons for general broadband based investment initiatives among governments and private investors in telecommunication sector. The main finding of the investigation is that the following five drivers can be seen as the "very main drivers" motivating

public and private sector to invest: (1) overall growth of economy in a country; (2) regional and local growth; (3) social benefits for citizens; (4) return on investment; (5) regulatory environment. The first three drivers are mainly applicable to the public sector investments and the last two are applicable mainly to the private sector broadband based investments. It is worth mentioning that all five drivers are the very main variables that were plucked from the variety of other relevant variables based on the analysis of the historical data presented in the literature review chapter. Broadband investments have its “spill-over” effects. For example, it is argued in the literature that public and private investments in broadband has an important impact on other sectors in the economy, and that they therefore are helping justify the initial investments (OECD, 2009/2). Public sector invests in broadband partly because it has “cost saving” effect on other sectors of economy, such as electricity, health, transportation and education.

#### **“Economic growth” and “Regional development”:**

Normally, the questions of modernization, innovation and competitiveness of economies on the global scale are central to the governments. Investment in broadband are affecting the growths rates of economies on the regional and national levels – there are evidence that infrastructure determines the growth and, therefore, is seen as “an engine for development”. Broadband investment, therefore, is seen as a platform for innovation and overall economic growth in the country. The reviewed literature seems to be pointing out that the productivity and growth are one of the main reasons for them to invest and it is widely accepted between governments that high speed communication networks are platforms that support innovation throughout the economies. Even though the empirical evidence of broadband impact on productivity and growth of economy are limited and arguable, the governments seem to motivate their own investments in infrastructure and their efforts to promote such investments for further broadband implementation based on the believe in ability of broadband to affect the growth and productivity. In that respect, governments are working on creating a framework that would allow even faster growth of innovative services and competitiveness of businesses and economy.

The governments are the central body that is able to maximize both economic and social benefits for its businesses and people by using a number of

methods. They stimulate the investment, for example, regulate the markets and even become investors when they need to make sure that the markets are creating value, developing and bringing economic and social benefits and overall growth to the economy. This so-called “overall economic growth” is beneficial to the governments themselves and their citizens.

It is important to note that the recent economic crisis (started in 2008) has its impact on the drivers behind broadband based investments. It caused reduction in custom and business confidence and affected the desire of the private sector to invest. At the same time, the crisis pushed the governments to acknowledge the crucial role of broadband for economic recovery and made them start to invest heavily in broadband infrastructure building and stimulation of private investments. To go further, in all the countries inside the Northern Sea Region broadband based investments were included in overall economic stimulus packages.

In the current paper such driver as “regional development and growth” is seen not just as a function of economic growth, but an independent variable. The goal of the government in this case is creating as much value as possible, not only for the whole economy of the country, but equally, for every region of it, for both highly dynamic centers and remote areas. Such growth would bring economic and social benefits to the residents of the regions, which is, at the end would be beneficial to the governments. In undeveloped regions and rural areas governments are forced to intervene into the markets due to its “unattractiveness” to the private investors. Such interventions, as made obvious by the literature, can be both successful or cause a market failure. In the case when governments are acting as investors, they make sure that their initiatives are warranted. In this case, the main driver or a warranty for the investment is “regional growth” – which would lead to all sorts of different positive outcomes for local businesses, sectors of economy, as well as social benefits for its citizens and its attractiveness for future investments and other economic activities.

#### **“Social benefit”:**

There are recommendations created by OECD specialists pointing the areas that governments should allocate their investments. Those areas are, as mentioned in the previous chapter: improvement and connectivity; incensement of

competition; stimulation of innovation and growth; and, incensement of social benefits. It is expected that public investment in broadband will eventually positively affect and improve the mentioned areas. At the end of the day, it seems this would affect overall growth in economy, growth in regions and create social value for the people and businesses. The social value creation is seen to be one of the most powerful drivers behind public broadband investments. Investments in telecommunication sector have both direct and indirect effects of the social benefits for the population. Examples of such benefits can be found in several chapters of the current paper and includes a list of them. Indirect social benefits are not only directly benefiting the people of the regions, but also have its spill-over effects that impacts different sectors of economy on the local and national level. Eventually, it all ends up in benefitting the region and the economy as a whole. Therefore, the positive social effects are beneficial not only to the people in a particular locality, but also to the people in the regions and the entire nation.

While governments are pointing out the social benefits for businesses and individuals as on the main driver force behind the investment, many individuals and businesses, as noted earlier in the current paper, are not even aware of the benefits and possibilities that high-speed broadband connectivity can give. This happens due to the lack of need, high cost or even lack of computer skills. Then the reasonable question arises about the awareness of the real situation by governments and the level of government's ambitions when it comes to actual utilization capacities of the end user. Where do such government ambitions come from? What are they basing their decisions upon? As noted by Fornfeldt (2008), so far the investments are not as beneficial to the businesses and individuals as expected by governments due to lack of social and economical impact. Of course, this point of view is arguable. Nevertheless, it may have grounds and businesses/individuals may need some governmental help when it comes to learning how best to utilize available broadband connectivity by both legal, R&D or educative procedures, new services and technological solutions for businesses. It seem like the governments have a very futuristic view on how things ideally should be in the future and for the future – and the impression one gets from the reviewed literature, is that while government are busy with an idea of 100 per cent connectivity and its huge impact on the growth of economy, businesses and the individuals are far behind in ability to develop matching applications and services

for the excising capacity or simply fail to fully utilize it. Thus, the utilization phase of the broadband is in the future, and its major spill-over effects as well as return on investments is in the distant future. As it was suggested earlier in the literature analysis chapter, governments should not only focus on increasing broadband coverage and its speed, but also on some projects stimulating both companies and individuals to utilize available broadband capacities.

**“Return on investment” and “regulatory environment” (for private sector investments):**

When it comes to determining the main drivers behind private broadband-based investments in the telecommunication sector, on that note the literature points to two main direct criteria: the returns on investments (mercantile returns) and regulatory environment. The literature and the interviewees both indicate the private sector’s main interest as being a bottom line/return on investment. Nevertheless, factors that are influencing the decision of private sector to invest or not-to-invest in a certain technology or infrastructure are many. For example, some companies do not want to take risks when it comes to new and unproven technologies, others are afraid to invest in the local loop because of possibility of price competition that may drive prices on their serviced down to below the rare that allows investors to recuperate their investments; the third ones are concerned about the regulatory risk, when the regulating body may step in on the market and cause some potentially negative effects for investors (this point is mostly applicable to the new fibre markets that are not fully regulated yet).

One of the main rules for general investment is the ability of investment to bring mercantile returns – totally applicable for the telecommunication investments. Many operators are investing gladly in high-density population areas or upgrading their own existing networks, but often hesitate to build new infrastructure in rural and low populated areas where build-out cost is high. It is important to note that the discussion as to whether to invest or not, would also be affected by the general investment strategy of the company. This means that the investment initiative would be determined by whether a company is interested in long-term or short-time returns on their investments. Not only that, but the decision would also be affected by the status of the company – whether it is an incumbent or a new entrant. Usually, no social benefits or spill-over effects are

being considered by the operators during the decision making process whether to invest or not in a particular area. One can find cases when even though social returns of broadband are potentially larger than the building costs, operators don't invest because their private returns just wouldn't justify the investment<sup>62</sup>. In other cases, companies are being stimulated by the governments and some beneficial agreements are being made. One of the rare cases when telecommunication sector may invest in potentially risky and low-on-return projects is when it may give some social benefits for the population that the company will monetized by. For example, by extracting payments for certain spill-over effects. High cost of network building in rural and remote areas make operator unwilling to extend their networks in those areas without government intervention in the way of different subsidies or mandatory coverage requirements (OECD, 2009/2). It has been mentioned that "Given the high costs of rolling out new networks, markets may not be able to sustain multiple infrastructure providers, resulting in non-competitive provision particularly less-dense areas" (OECD, 2009/2, p.13).

Generally, governments try not to intervene in the market, as noted above, nevertheless, they are totally regulating the markets, causing private investors not only to consider the possible returns on the invested capital, but also to consider regulation law and regulatory risks. Depending on the situation on the market, additionally to the standard investment determinants, such as cost of capital and ROI, investment decisions seem to be quite sensitive to the regulatory environment. The main point here is that the investment decisions are irreversible and, therefore, regulation conditions play an important role in decision-making for both private and public investment initiatives through its ability to determine possible return on investment, pricing, barriers of entry and other (ECO, 2009). In that respect the government as a regulator can cause potential difficulties, such as political and private interest pressures, and problems related to asymmetries of information and lack of credibility (OECD, 2005), which would naturally effect investment decisions by the private sector. Further acknowledged is that "when it is appropriately designed, regulatory independence should help both improve the quality of regulation and, by holding the regulator accountable for implementing

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<sup>62</sup> DSTI/ICCP/CISP(2009)2/FINAL



its mandate, reduce the discretion that the regulator can exercise” (ECO, 2009, p.30).

As it is noted in the literature, the public sector is very considerate concerning the market when it comes to the infrastructure investments. One of the reasons behind it is the market failure – the reason that makes public sector to intervene into the market to prevent under- or non-provision of the infrastructure (for example, in rural areas). Public investments can be absolutely inefficient (over-investment and under-investment) and leads to, for example, misallocation of resources across regions and sectors (ECO, 2009). Again, regulatory risks, therefore, may be seen as both drivers and “barriers” for investments. As it is pointed out in the literature, investment initiatives are directly affected by regulation – first of all “access regulation” and the “quality” of the regulatory regime in the market. Such regulations in the market are affecting investor’s profitability, competition in the market and, again, the return on investments. Therefore, the “mild” or “telecom friendly” regime may drive the investment decision or a company may consider it to be too risky if the regime is “hush” in their opinion. In this respect, the attempts of governments to stimulate the investments can have a good effect coupled with mild regulation regime in the market.

### **3.3. The discussion and the main findings of the empirical research**

Three persons with an appropriate employment background were interviewed by the researcher in autumn 2010 in Oslo, Norway. The reason behind those interviews was, as noted earlier, to collect data that would contribute to the refinement and straitening of the theoretical findings made on the basis of literature review analysis. The interviewees were asked three questions that had been mentioned in the Introduction to the current paper (p. 9). The questions were designed by the researcher to provide data showing main trends in the policies connected to broadband based investments in Norway. The mentioned questions

were not a reflection of any particular theoretical framework. The questions were created by the researcher of the current thesis with intention to find out more about the area of research. The current part of the discussion and result chapter includes discussion of findings based on the information provided by the interviewees. The current sub-category is structured as follows: the question that the interviewees were asked is followed by the analysis and discussion of their answers.

### **1. What would you say that the main drivers for broadband-based investments are?**

Halvor Ødegård, senior adviser at the Ministry of Government Administration, Reform and Church Affairs, responded on the first question about the main drivers for broadband-based investments that “in general, governments subsidize investments in broadband because they believe there are market imperfections which suggest that the market outcome will not be the best outcome for society as a whole”. He also added that main drivers for the public investments are as follows: *productivity and innovation* (brought by broadband), and, as a function of that, an *overall growth of country’s GDP; social aspect; benefits for other sectors in economy*; attractiveness for businesses and individuals of rural areas (*regional development*).

Mr. Ødegård explained that, in his opinion, governments consider broadband as an infrastructure that is necessary in order to realize and utilize the benefits brought by the “information society”. Broadband access with sufficient capacity is necessary for efficient use of ICT both in the private and in the public sector. He confirmed that governments have evidence and believes that use of ICT in businesses increases productivity, innovation rate and, therefore, is important as a contributor for the growth of nations’ GDP. Broadband, according to Mr. Ødegård, is important for Norwegian government: “sufficient broadband access to all is necessary so that citizens, independent of geographical location and income, have the same opportunities with respect to societal participation, public services, cultural services, ecommerce, etc.” Sufficient broadband capacity is probably a prerequisite for achieving governments’ ambitions in other sectors of economy, such as, for example, e-government, education and health sector. In addition, Mr.

Ødegård made it clear that local governments in Norway invest in broadband with intention to attract more people to local communities, especially to communities in rural regions.

Similar point of view on the broadband based investments and the drivers behind it had been expressed by the second interviewee Mr. Hans Einar Nerhus, a senior adviser at the Norwegian ministry of transport and communications. Mr. Nerhus is certain that *economic growth* and *regional development* are the two major drivers behind broadband based investment initiatives in the Norwegian public sector. To quote Hans Einar Nerhus, “ICT and broadband has this drive to make other businesses flourish or to grow, so I think the main political motivation is the economic growth. Then, the second political interest might be a regional development aspect of it. For Norway it has always been a big political focus point, to have also smaller places in Norway should be able to compete, to make use of new technologies and broadband, not necessarily in ICT industry, but also other industries will have bigger potential if they are connected to the internet.”

The third main driver Mr. Nerhus mentioned was “*equality*” of all *Norwegian territories in terms of availability of the same services*: “as a part of regional development, you have all the same kinds of services from product services and entertainment and TV and so on for the whole country. That is also one of the drivers.” The next driver he mentioned was *technology*, especially wireless technology which, in his opinion, supports broadband speed and broadband applications. At last, but not least, the respondent noted that broadband *affects other industries*, which brings overall growth on local and national levels: “For Norway it has always been a big political focus point, to have also smaller places in Norway should be able to compete, to make use of new technologies and broadband, not necessarily in ICT industry, but also other industries will have bigger potential if they are connected to the internet. I mean I have examples of that in many places, an early example is an “online photo shop”, you send your photos there and maybe they will copy it for you or store it for you, and that is based in a very small village in the Western part of Norway. Also for ship industries and other industries”. Mr. Nerhus pointed out that Norway has not invested so much governmental or public money into broadband development. Norwegian government uses public money mostly for *stimulation of markets*,

which in itself can also be called as a driver for broadband development in Norway.

The third interviewee, Mr. Eivind Lorentzen, a senior adviser at the Ministry of Trade and Industry (Norway), talked about broadband drivers similarly to Mr. Nerhus and Mr. Ødegård. Namely, Mr. Lorentzen said that, in his opinion, the main reasons why Norwegian public sector invests into broadband connectivity is a thought of a whole society that is going to benefit from it (*social benefits of broadband*) and *economic growth* (growth and development on the market) for Norwegian businesses. The interviewee pointed out that, according to studies undertaken by the ministries, two of the main drivers for the investment initiatives in broadband infrastructure building for the public sector in Norway are as follows: “(1) changes in user patterns towards uses that require more capacity and (2) the increased demand for connectivity in number of connected users<sup>63</sup>”. Mr. Lorentzen advised the researcher of the current paper to look at Nexia/Econ Pöyry l ”*Bredbånd 2.0 – status og utvikling mot 2015*” – a report that could be useful for the current master thesis research. His advice was taken into account and the researcher found numerous amount of valuable information that was then reviewed and analyzed. When it came to mentioning some economical reasoning behind the public sector investments, Mr. Lorentzen explained that market-based development ensures the most efficient allocation of resources, i.e. the widest broadband expansion for the least amount of resources. “This is a standard theory and supported by empirical studies (OECD)”, he added. Broadband infrastructure partially has characteristics of a collective good, i.e. purely market-based development may fall short of optimum coverage for society as a whole. So the policy issue becomes addressing the residual without limiting the incentives for market-based development.

Overall, all three respondents seem to put forward the idea about *economy and growth, social benefits, benefits for businesses and local communities, benefits for other sectors of economy and technological development*, as well as *demand in the market*, as main drivers for governments to invest in broadband infrastructure building.

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<sup>63</sup> Connectivity in number of connected users literally means relationship between the number of situations in which the users are connected and the number of devices with which they are connected simultaneously.

**2. Do you think the main drivers (that you mentioned answering the first question) are likely to change in future broadband-based investments?**

With regards to the question about the possible changes of the main drivers in future Mr. Ødegård responded that it is unlikely that the drivers he mentioned earlier are likely to change in future, but noted that “there might be additional drivers, like green ICTs, i.e. where ICT is used to reduce CO2 emissions. Broadband access will be an integral part of this”. Another respondent fully supporting Mr. Ødegård’s point of view is Mr. Hans Einar Nerhus, who thinks that the main drivers are unlikely to change in future. Mr. Nerhus agreed, nevertheless, that there is possibility of some changes in future, but still it is most likely that they are going to remain the same for the nearest future. He noted that the capacity of broadband will vary between places. He reminded that the Norwegian government started out with a project “broadband for all” in 1998, with a goal for everybody to have “some kind of broadband connection”, and now (in 2010) the new target is “faster broadband for all”. “It is an ambitious target”, he notes, and agreed that it is a very difficult target to reach, but Norwegian government is regulating and stimulating the markets in the way that they hope will achieve faster broadband for the most of households in Norway. Additionally, Mr. Nerhus suggests that the “new technology and wireless, obviously, will be the main driver in time to come”.

Eivind Lorentzen in the interview suggested that, when it comes to the driver for the public sector investment initiatives, the demand for broadband capacity will determine the future trends. To quote Mr. Lorentzen: “the specific uses requiring more capacity will likely change, and similarly the situations in which users require connectivity will most likely undergo changes. One of many drivers mentioned by OECD and others are increased machine-to-machine communication - “the internet of things”. The constant trend towards increased demand for capacity and connectivity seems however to be supported by most studies, while the estimates of rate of change in demand vary.”

Overall, all the respondents seem to agree that the *main drivers will stay the same*, but the level of demand for higher broadband capacity and new related

services, as well as new technologies will, most likely, grow and can become one of the main reasons for investment initiatives from the public sector.

**3. Do you think that the reasons – the drivers – for investment differ from the private sector to the public sector? How do they differ? Why do they differ?**

All three interviewees, answering on the third question, agreed that the drivers behind the private sector investments definitely differ from the ones that drive the public sector investments. The respondents also agreed that the essential driver for the private sector investment initiatives is of “*commercial reasons*”. “Private sector invests in broadband for commercial reasons, to increase profits”, concluded Mr. Ødegård. Mr. Lorentzen supported his colleague saying that “private sector broad band investments are and should be based on ordinary commercial considerations. Norwegian broadband policy is based on maximizing market based broadband development”. Mr. Nerhus went further and explained that, in his opinion, “private sector invests in broadband infrastructure because they think that there is a market there. They have returns on investments and that is their main driver - they are interested in making money”. He also noted, that he can see that there are two different kinds of motivation in the investment initiative: (1) old traditional “teleco” (Telenor and others) that usually have a time span on the investments (return on investments), maybe around 4-5 years; (2) at the same time a lot of the new players, especially in the fiber market, like Lyse and a lot of the ex-power facilities, electricity companies, who have gone over to the fiber business and who have their old traditions and a much longer time frame for the investments, maybe it is 20 years or 50 years. The last ones say that the fiber will last forever, which means that they could use more money now than the teleco industry. “So, there are different motivations within the private industry”, Mr. Nerhus confirms.

The interviewees compared motivations or drivers behind the private sector and the private sector investments. Mr. Ødegård noted that while the private sector is purely focused on earning money out of broadband, the governments invest in broadband to increase welfare for the entire society. Both other interviewees agreed with this statement. “The public sector addresses any

remaining residual. This is in concordance with OECD recommendations. The aims of government in extending coverage beyond what the market provides – and aiming towards complete coverage – include, but are not limited to, ensuring equal quality in public services, ensuring an equal playing field for enterprises and fostering innovation and regional development”, noted Mr. Lorentzen, followed by Mr. Nerhus, who named few crucial differences between the drivers behind spending on broadband by private and public sector. The first motivation, says Mr. Nerhus, is the same for both – it is *economic growth*. “That is a reason for government to intervene in the market is to stimulate the market to invest in the areas where they are not sure in getting money back. That is how we use government’s investments in Norway”, explains Mr. Nerhus. In his opinion, this way is different from some other countries. Mr. Nerhus gives some examples to support his point of view by saying that sometimes public money could take away risk for market players and for investors. “So, if the responsible for the broadband funding public body sees that an organization might have a business case that in one sparsely populated area, but it is very unsure, but of bit public money will make it to sign investment, then they may contribute and that is how Norwegian public money have been spent in broadband”, - explains Mr. Nerhus.

According to the interviewees it is clear, that the Norwegian government is not interfering with business, in the market, but a lot of municipalities and counties are allowed to use “their own money”, or money they are getting from the state, in order to go out in the market, request broadband development in their area and get their offerings from telecoms. After the received offering the municipalities analyze the costs and benefits for the community and the people and make their investment decision. In other words, the public sector in Norway often has to do “job” from the public side in order to the market to come and invest in their areas. Mr. Nerhus points out that there are different kinds of public money in Norway: “a few years ago we had a secretariat in Norwegian Research Council, called Høycom and they had quite a few money to go in the market and to get broadband, but we no longer have that kind of money, so now it is down to municipalities and counties to use their money in order to get broadband investments. All the money is the same at the start, but it’s the ministry of regional development who, at the moment, has money to spend on broadband. They send this money down to counties to invest into broadband”. One of the

important aspects of the way Norway spend it money was mentioned by Mr. Nehrus, when he said that Norway follows the EU regulations, it follows the EU guideline for broadband investments. Norway mostly based their investment initiatives in line with those guidelines. Nevertheless, even though Norway had to apply for the EU rules, it had never gotten so-called “regional development money” as other countries in the EU. Mr. Nehrus noted that he “is not certain about other Nordic countries, especially Sweden, gets quite a bit of money back from the EU to use on broadband investments”.

Overall, analysis of the interviewee’s answers shows that there are two main drivers that worth mentioning when it comes to the broadband based investments in the private sector. Namely, *commercial reasons/return on investment* and *stimulation from the public sector*. The motivation and the time frame for investment may vary, though, depending on the status and position of the investing private company on the market. It is clear that the private sector is, generally, focused on getting their profits out of the utilizing the infrastructure they have been investing into. It is also clear, that the public sector is mostly interested in the economic and regional growth in the country; stimulation of the market in order to attract private investments and support innovation; increased welfare of the society/social benefits and, finally, they are following the EU and the OECD guidelines, especially designed for public sector broadband based investment initiatives.

### **3.4. Summary**

During the discussion of literature review and discussion of interviewees’ responses, presented in the current chapter, the main drivers for broadband-based investments were identified. The findings are supporting the hypothesis about broadband based investments in the Northern Sea Region being influenced by a range of factors. Among the identified factors, or drivers, some are mostly applicable to explain the initiatives behind the public sector investments and some are mostly applicable for the private sector investments motivations.



## 4. Reflections

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### 4.1. Limitations of the study

The main limitations of the current study are reflected by the limitations of the methodology that had been used for the research. The chosen methodology has two main limitations. The main focus of the current study is on the historically created relationship between investment initiatives and drivers behind those initiatives. Due to large numbers of possible reasons deducted from the reviewed literature for each and every country within the Northern Sea Region separately for the private and the public sectors, this study had only been focusing on the very main, obvious drivers that are absolutely central and applicable for each country of the mentioned region and both mentioned sectors. More detailed and country- or sector- specific identification of the investment criteria in broadband building is left to future research.

Another limitation of the chosen methodology is – the “unpredictability” of the methodology. As it is nicely put by Hague (2004), as one is a novice in desk-based literature review , there can be “no certainty of what the desk research will yield and what gaps will remain” (p.11).

### 4.2. Future research recommendations

The current study reveals that the governments are mostly investing in broadband infrastructure building strongly believing that this will bring significant benefits to the country in terms of positive impact on country’s economic growth and regional development, as well as social benefits to the citizens. So far, as noted by Fornefeld (2008), the benefits to business and citizens are not as obvious as expected by governments due to lack of social and economical impact. Therefore, the obvious direction on further research will be to fairly research both microeconomic and macroeconomic impact of broadband-based investments on

growth in economy and specifically on regional and local development. The current study also reveals a need for governments to conduct some serious research on a regulatory environment for broadband-based investments for private and public sector investors.

## 5. Conclusion

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The extended literature review combined with interviews<sup>64</sup> conducted for the current paper has indicated that investment in broadband infrastructure deployment is being influenced by a range of different factors. It looks like the main drivers for broadband-based investment for private sector are different to the ones that influence public sector investment initiatives. While the private actors are purely focus on achieving as much return on their investment as possible, the governments are most concerned with positive macroeconomic and social impacts of broadband on the country's economies. The findings are mostly applicable for the countries within the Northern Sea Region. Nevertheless, the findings can still be generalized to the countries with developed economies. Further research is required to fully understand and test the finding of the current paper that could be used by both private companies and public bodies as a guideline for further research.

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<sup>64</sup> see Introduction to the current thesis, p. 9.

# Bibliography

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ABS. (2008-09). *Household Use of Information Technology*. Australia: Australian Bureau of Statistics.

Baake, P. (2006). *Local loop unbundling and bitstream access: regulatory practice in Europe and the U.S.* Berlin: DIW.

Basu, S. F. (2003). *The case of missing productivity growth: or, does information technology explain why productivity accelerated in the United States but not in the United Kingdom?* Cambridge, MA: NBER.

BMWi. (2009). *Breitbandstrategie der Bundesregierung*. Berlin: Bundesministerium für Wirtschaft und Technologie.

Bouckaert J., T. v. (2008). *Regulation and broadband penetration - What is required to regain speed in Belgium?* Belgium.

BT Business. (2007, April). State of small business nation. UK, UK.

Cadman, R. (2007). *Regulation and Investment in European Telecom Markets*. Hentet 2010 fra [http://www.ectaportal.com/en/upload/File/Regulatorypercent20Scorecards/2007/Euro\\_investment\\_paper.pdf](http://www.ectaportal.com/en/upload/File/Regulatorypercent20Scorecards/2007/Euro_investment_paper.pdf).

Carlaw, K. I. (2007). *the past, present and future of the GPT-driven modern ICT revolution*. Department of Economics. Kelowna: Industry Canada.

Cave, M. (2006). Encouraging infrastructure competition via the Ladder of Investment. *Telecommunications Policy*, 30, 223-237.

Collins P., D. D. (2007). *The economic effects of broadband: an Australian perspective*. Australia: Research statistics and technology branch, Department of Communications, Information Technology and the Arts.

COM. (2008). *Broadband access in the EU: situation at 1 July 2008*. Brussel: European Commission, Information Society and Media Directorate - General.

COM. (2009). *Europe's Digital Competitiveness Report Volume 1: i2010 - Annual Information Society Report 2009 Benchmarking i2010: Trends and main achievements*. Brussels: Commission of the European Communities.

Crafts, N. (2003, May). Steam as a general purpose technology: a growth accounting perspective. *Working Paper 75/03*. London: Department of Economic History of London School of Economics.

David, P. (1990). The dynamo and the computer: an historical perspective on the modern Productivity Paradox. *Papers and Proceedings of the Hundred and Second*

- Annual Meeting of the American Economic Association* (ss. 355-361). The American Economic Review.
- Dicken, P. (2007). *Global Shift: Mapping the changing contours of the world economy*, - 5th edition. USA: The Guilford Press.
- Eclipse. (2009). *Eclipse Internet*. Hentet mai 2009 fra <http://www.eclipse.net.uk/about-eclipse/business-news/article.cfm?articleid=843>
- ECO. (2009). *Infrastructure investment: links to growth and the role of public policies*. Economics department. Paris: OECD.
- ECTA. (2009). *Broadband Scorecard Q-3 - 2008*. Brussels: ECTA.
- Epractice.eu. (2008). *Belgium- Country profile*. Hentet 2010 fra <http://www.epractice.eu/files/media/media2030.pdf>
- Epractice.eu. (2010, July 08). *eGovernment Factsheet - Norway - Strategy*. Hentet 2010 fra <http://www.epractice.eu/en/document/288459>
- Epractice.eu. (2010/1, June). *eGovernment Factsheet - Sweden - Strategy*. Hentet February 2010 fra <http://www.epractice.eu/en/document/288378>
- Eurostat. (2006). Community survey on ICT use in enterprises.
- Eurostat. (2009c). Enterprises sending and/or receiving e-invoices - tin00114.
- Eurostat. (2009a). Enterprises using the Internet for interaction with public authorities - tin00107.
- Eurostat. (2009). Enterprises which have broadband access-tin00090. Eurostat.
- Eurostat. (2009b). ICT usage by enterprises 2009.
- Eurostat. (2008). ICT usage by enterprises 48/2008.
- FAD. (2007). *The Norwegian Ministry of Government, Administration and Reform*. Hentet 2010 fra [http://www.regjeringen.no/upload/FAD/Vedlegg/FAD/FADbrosjyre\\_kor.pdf](http://www.regjeringen.no/upload/FAD/Vedlegg/FAD/FADbrosjyre_kor.pdf)
- Farooqui, S. a. (2006). *Broadband availability, use and impact on returns to ICT in UK firms*. OECD.
- Farrell, J. K. (2006). *Co-ordination and Lock-in: Competition with Switching Costs and Network Effects*. USA: Competition Policy Center, Institute for Business and Economic Research, UC Berkeley.
- Fernald, J. B. (2006). *Information and Communications Technology as a General-Purpose Technology: Evidence from U.S. Industry Data*. San Francisco: Federal Reserve Bank of San Francisco.

- Fornefeld. (2008). *The impact of Broadband on Growth and Productivity*. MICUS (Management Consulting GmbH).
- Forskningsrådet. (2007). *IT Funk: Research, development and innovation to promote information and communication technology for the disabled – and for all*. Hentet 2010 fra <http://www.itfunk.org/docs/engpres.html>
- Frankfort-Nachimas, C. N. (2006). *Research methods in the social sciences - fifth edition*. London: Hodder Arnold.
- Fukukawa, K. (2009). *Corporate Social Responsibility in Asia*. Taylor and Francis Group.
- Gartner. (2009, March 30). *Gartner Says Worldwide Enterprise Software Market to Experience Flat Growth in 2009*. Hentet 2009 fra <http://www.gartner.com/it/page.jsp?id=923312>
- Ghuri, P. G. (2005). *Research methods in business studies - a practical guide*. Essex: Pearson Education Limited.
- Govindarajan, V. G. (2000). An analysis of the emerging global arena. *European Management Journal*. 18, 3 , 274-284.
- Hamam, S. &. (2007, Volume 2). Social impact of broadband internet: a case study in the Shippagan area, a rural zone in atlantic Canada. *Journal of Information, Information Technology, and Organizations* .
- IDATE. (2008). *Broadband Coverage in Europe - Final Report 2009 Survey*. IDATE Consulting and Research.
- ITU. (2007). *Measuring the Information Society 2007: ICT Opportunity Index and World Telecommunication/ICT Indicators*. Geneva: International Telecommunication Union.
- Jahren, E. (2009). *Mål og virkemidler for bredere bredbånd*. Oslo: Fornyings- og administrasjonsdepartementet.
- Jankowicz, A. (2002). *Business Research Projects (3rd ed.)*. London: Thompson.
- Kox. (2005). *Intra-EU differences in regulation-caused administrative burden for companies*. CPB Netherlands Bureau for Economic Policy Analysis.
- Lehr, W. H. (2006). *Measuring Broadband's Economic Impact*. Final report prepared for the U.S. Department of Commerce, Economic Development Administration.
- Lorentzen, E. (2010). Broadband-based investments in Norway. (V. Tveitevøll, Intervjuer)
- Martin, K. J. (2008). Statement of chairman Kevin J. Martin. (W. D.-3. 07-45, Interviewer) FCC.
- Muselaers N., S. R. (2010). *Regulatory policy note 6: Regulation, risk and investment incentives*. OPTA Expertise Centre.

Nerhus, H. E. (2010). Broadband-based investments in Norway. (V. Tveitevoll, Intervjuer)

Newrly, P. V. (2009). *How to strengthen digital literacy? Practical example of a European initiative "SPreaD"*. Hentet 2010 fra [http://www.epractice.eu/files/Howper cent20to per cent20strengthenper cent20digitalper cent20literacyper cent20-per cent20Practicalper cent20exampleper cent20ofper cent20aper cent20Europeanper cent20initiativeper cent20SPreaD.pdf](http://www.epractice.eu/files/Howper%20to%20strengthenper%20digitalper%20literacyper%20-per%20Practicalper%20exampleper%20ofper%20aper%20Europeanper%20initiativeper%20SPreaD.pdf)

Nexia og Econ Pöyry. (2009). *Bredbånd 2.0 - status og utvikling mot 2015*. Nexia og Econ Pöyry.

NMFA. (2009). *Corporate social responsibility in a global economy*. Oslo: Norwegian Ministry of Foreign Affairs.

Ødegård, H. (2010). Broadband-based investments in Norway. (V. Tveitevoll, Intervjuer)

OECD. (2010). 1m. Fixed (wired) broadband penetration, historical time series (June 2010).

OECD. (2008b). *BROADBAND AND THE ECONOMY*. DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY, COMMITTEE FOR INFORMATION, COMPUTER AND COMMUNICATIONS POLICY.

OECD. (2007/3). *Broadband and the economy, 2008*. Paris: OECD.

OECD. (2005). *Designing independent and accountable regulatory authorities for high quality regulation*. London: OECD.

OECD. (2007/4). *Developments in fibre technologies and investment*. Paris: OECD.

OECD. (2004). *Information Technology Outlook 2004*. Paris: OECD.

OECD. (2006). *Internet traffic prioritization: an overview*. Paris: OECD.

OECD. (2009/2). *Network developments in support of innovation and user needs*. Paris: OECD.

OECD. (2007). *OECD Communication Outlook 2007*. Paris: OECD.

OECD. (2009a). *OECD Communications Outlook 2009*. Paris: OECD.

OECD. (2008). *OECD Information Technology Outlook 2008*. Paris: OECD.

OECD. (2009). *Policy Responses to the economic crisis: investing in innovation for long-term growth*. Paris: OECD.

OECD. (2004a). *Recommendation of the Council on broadband development*. OECD.

OECD. (2007/6). *The influence of market developments and policies on telecommunication investment*. Paris: OECD.

OECD. (2009/1). *The role of communication infrastructure investment in economic recovery*. Paris: OECD.

Olson, D. L. (2004). Cost/Benefit Analysis. I H. Bidgoli, *Encyclopedia of Information Systems, four-volume set* (ss. 333-344). Bakersfield: California State University.

Parliamentary Office of Science and Technology. (2008, April). Next Generation Broadband Access. (305) . London: The Parliamentary Office of Science and Technology.

Pietrunti, M. (2008). Regulation and investment incentives for next generation broadband access networks.

Pindyck, R. (2007). *Governance, Issuance Restrictions, And Competition In Payment Card Networks*. National Bureau of Economic Research, Inc.

SEC. (2004). *Connecting Europe at High Speed: National Broadband Strategies*. Brussels: COMMISSION OF THE EUROPEAN COMMUNITIES.

SEC. (2004). *Connecting Europe at High Speed: National Broadband Strategies*. Brussels: Commission of the European Communities.

Strande. (2007). *eNorway and Norway Digital as Tools in Good Governance, Risk and Environment Management*. Hønefoss: Norwegian mapping and cadastre authority.

Total Telecom. (2007). *Is fibre to the cabinet a disaster for local loop unbundlers?* Hentet fra <http://www.analysismason.com/About-Us/News/Newsletter/Previous-news-articles/Is-fibre-to-the-cabinet-a-disaster-for-local-loop-unbundlers/>

Warf, B. (2006). International Competition Between Satellite and Fiber Optic Carriers: a geographic Perspective. *The professional geographer*, 58 , 1-11.

Waverman, L. (2007). The Economics of Mobile Telecommunications. I H. Gruber, *Economica* (ss. Volume 74, issue 296: 872-873). doi: 10.1111/j.1468-0335.2007.00601\_6.x.

Wikipedia. (2010). *Optical fiber*. Hentet fra [http://en.wikipedia.org/wiki/Optical\\_fiber](http://en.wikipedia.org/wiki/Optical_fiber)

Wikipedia/1. (2010, september). *Broadband Internet access*. Hentet september 2010 fra [http://en.wikipedia.org/wiki/Broadband\\_Internet\\_access](http://en.wikipedia.org/wiki/Broadband_Internet_access)



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