Denmark as a high-speed society

The High Speed Committee 2010

Danmark as a high-speed society
The High Speed Committee, January 2010
www.h jhastighedskomiteen.dk

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Design by Siegel Design
Photos by Folketinget.dk, Colourbox.dk

ISBN: 978-87-92572-11-0

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Issued: Janaur 2010
The High Speed Committee

Content

Foreword **5**

Summary **6**

1 Denmark as a high-speed society **9**
1.1 Burning platforms 9
1.2 Growth 9
1.3 Welfare 10
1.4 Democracy, culture and participation 11
1.5 Climate and environment 11

2 Opportunities and challenges in a high-speed society **13**
2.1 New opportunities for value creation 13
2.2 The users drive development 14
2.3 Political ownership and priority 15

3 How Denmark will become a high-speed society **17**
3.1 Digitalisation in the public sector. 19
3.2 The public sector as a platform for innovation 27
3.3 Denmark as a Cloud nation 33
3.4 Information and IT skills 37
3.5 Environment, climate and green IT 43
3.6 Research and development in the field of IT 49
3.7 Broadband infrastructure in Denmark 55

Foreword

The Ministry of Science, Technology and Innovation appointed the High Speed Committee in spring 2009.

The committee's terms of reference state that recommendations concerning improvement of developing Denmark as a high-speed society with regards to both technology and applicability must be stated in order to maintain Denmark's position as one of the world's most competitive societies.

The members of the committee

The Ministry of Science, Technology and Innovation has appointed following individuals as members of the High Speed Committee:

- Erik Bonnerup (chairman),
  former head of department and managing director
- Eva Berneke,
  group director and head of strategy, TDC
- Peter Friis,
  director, Google Denmark
- Birger Hauge,
  director, Hand Over Foundation A/S
- Jesper Hjulmand,
  managing director, SEAS-NVE
- Niels Højberg,
  city director, Århus Municipality
- Ole Ivanoff,
  director, Ivanoff Interactive
- Jane Eis Larsen,
  director, IT-Branchen
- Lars Monrad-Gylling,
  managing director, KMD
- Jesper Brøckner Nielsen,
  managing director, Telia Danmark
- Lars Qvortrup,
  dean, DPU, Aarhus University
- Knud Erik Skouby,
  professor, Aalborg University
- Anne Mette Thorhauge,
  post doc, University of Copenhagen
- Kim Østrup,
  vice director, IBM Danmark

Due to time considerations, Newspaper editor Ulrik Haagerup, DR, withdrew from the committee at the end of process.

The Ministry of Science, Technology and Innovation has placed secretarial assistance at the disposal of the High Speed Committee. Jakob Willer (head of secretariat), Kresten Bay, Anna Bay Damholt, Thomas Holmstrøm Frandzen, Morten Jørsum, Janus Sandsgaard, Griet Storr-Hansen and Thomas Wulff have contributed to the secretariat's work.

The process

The committee has held ten meetings.

During the process, the committee requested written contributions from all ministries and, in addition, received a range of written contributions from different organizations and business as well as fact sheets from the Ministry of Science, Technology and Innovation. These contributions are enclosed in the report's electronic appendices.

During the process, the committee has also had three consultancy reports and two memorandums prepared, which are also enclosed in the electronic appendices.

At the committee's meetings, a number of presentations by both members of the committee and external speakers were made.

During the process the committee has made two statements to the Minister of Science, Technology and Innovation:

- Statement of 18 May 2009 concerning the contemplated auction and utilization of 2.5 GHz radio frequencies
- Record for implementation of UMTS assets of 6 October 2009.

Erik Bonnerup
Chairman of the High Speed Committee

Summary

The application of IT[1] and broadband is essential to the development of Danish society and continued safeguarding of economic growth, welfare, democracy and a better climate. It is therefore an area in which we must concentrate and invest.

To the High Speed Committee it is absolutely necessary to launch a range of initiatives and activities, which will contribute to both increasing the prevalence and application of IT and broadband over the coming years, as well as realizing the government's vision of Denmark as a high-speed society.

The development of Denmark as a high-speed society by establishing rapid broadband connections must be viewed in the context of IT development in general. Modern infrastructure and rapid broadband connections are vital prerequisites for Denmark to be able to call itself a high-speed society.

It is vital that private trade and industry as well as the public sector are in a position where it is possible to employ all the new technologies in order to enhance the efficiency of business procedures, promote innovation, create new valuable content and deliver better services.

Implementation of these visions requires innovative thinking by both political and administrative managements. It is urgent that decision makers at all levels of society – political, administrative and business-related – ensure that new technological opportunities are implemented and used, and that emphasis is placed on realizing the benefits of using IT and broadband.

Opportunities for benefitting from digitalisation are constantly increasing - however, the gap between what is possible in terms of deriving the benefits and what the state, regions and municipalities actually do is widening. In terms of enhancing efficiency, many opportunities are provided by thinking interdisciplinary and coordinating processes and systems.

Therefore, the need for increased managerial focus on digitalisation and allocation of resources is great. It is merely a question of getting started.

In the report, the committee suggests a number of obvious possible initiatives and activities, which in practice can contribute to realizing the vision of Denmark as a high-speed society. The committee's aim has not been to draw up exhaustive descriptions but rather to call attention to some of the many activities, which can be implemented immediately. Nor has the committee proposed establishing new bodies or administrative solutions.

The specific recommendations are described in detail in chapter three of the report. The committee's recommendations are divided into the following areas:

1 IT in this context incorporates information technology, electronics, broadband and telecommunications.

- **Digitalisation of the public sector.**
  If Denmark is to achieve the necessary effects from implementation of new technology in public services, it will be necessary to ensure a coherent IT application with better cross public coordination, development of common standards and increased incentives for using digital solutions.

- **The public sector as a platform for innovation.**
  Increased focus on service orientation, open source software, open standards and access to public data as well as procurement of increased opportunities for user driven innovation are the basis of growth and innovation in trade and industry.

- **Cloud computing.**
  In order to ensure both greater efficiency and more environmentally correct IT usage, the public sector should place great concentration on cloud computing and on helping to solve challenges relating to data security, privacy etc. At the same time this will create a good foundation for establishing new, innovative businesses.

- **Information and IT skills.**
  Great concentration should be made in strengthening Danish information and IT skills in order to support and stimulate development and innovation force in trade and industry, the public sector and amongst citizens. Specifically concentration should be placed in strengthening IT in state schools and higher education.

- **Environment, climate and green IT.**
  IT and broadband can contribute to reducing energy consumption and lowering CO2 impact. Important areas concern the development of intelligent traffic systems, intelligent electricity systems and increased use of video conferencing.

- **Research and development in the IT area.**
  A marked increase in the volume of IT research and a strengthening of IT research environments should occur. In addition, concentration should be placed in strengthening public/private collaboration and focussing on Danish IT strong points, e.g. intelligent energy and traffic control, digital media and teaching aids as well as health IT, including as a basis for cluster organizations.

- **Broadband infrastructure in Denmark.**
  Good framework conditions for investing and performing business in the broadband area must be ensured in Denmark. The committee believes that it is important that the development of broadband infrastructure in Denmark should continue to be market based and technology neutral. The public sector should focus on stimulating the general public's use of broadband, which will increase the incentives for private parties to invest in broadband. In order to ensure broadband development, new visions and milestones should also be established that indicate political priorities in this area.


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1

Denmark as a high-speed society

1.1 Burning platforms

The High Speed Committee's work has taken as its basis the fact that Denmark faces some very major challenges – "burning platforms" – relating to:

Ensuring competitive ability and economic *growth*
- Productivity, efficiency and innovation capability in trade and industry is falling compared with other countries
- Trade and industry and the public sector have a strong need for highly educated IT specialists

Ensuring *welfare* through efficiency and quality in public services
- Citizens are placing constantly higher demands on the public sector's service provision whilst simultaneously there are fewer hands for the job

Ensuring *democracy, culture* and *participation* for all Danes
- 40 percent of Danes have poor or no IT skills

Ensuring that Denmark is prepared for *climate* and *environmental challenges*
- We need to reduce energy consumption and our CO2 impact

IT and broadband is a significant part of the solution to these challenges.

1.2 Growth

Development in productivity in Danish trade and industry has been low for a number of years, and Denmark is not fully benefitting from efforts to improve efficiency in comparison to countries with which we normally compare ourselves. This is somewhat a threat to Denmark's economy and welfare.

We are dependant on Danish businesses staying innovative and value adding. Danish businesses must be cutting edge in terms of value-adding initiatives and in that context make full use of IT. This is relevant for both the IT industry itself and other industries that can gain value in integrating IT into their business. This requires essential frameworks to be mad and for trade and industry and the public sector to have the necessary competencies to execute the development.

A wide range of countries in Europe – including Finland, Sweden, the UK and France – has formulated new strategies for tomorrow's society. Following the change of president, the USA has implemented major projects for testing high tech options in public administration. Many of the countries with which Denmark competes are to take major steps in this area.

It is also important to the development and application of IT in trade and industry to ensure that investment is made in a modern broadband infrastructure. In other words in the fibre optic network, cable TV network, extension of the copper network as well as wireless or mobile networks. It will not be possible to utilise the opportunities of digital technology without fully functioning infrastructure.

1.3 Welfare

A challenge exists in that there will be fewer individuals to manage the same jobs in the public sector. The proportion of children and pensioners in the population are increasing. Denmark therefore faces a demographic challenge, as we will have fewer people in employment age and more outside of it. For example, the workforce in the teaching and nursing sectors is comprised by a relatively high proportion of employees who will leave the job market in the next ten to fifteen years.

The increased workload can be relieved, but only with a clear input into better use of IT in the public sector. Public service products must focus more on creating incentives for the citizen to use digital solutions. For example, these incentives may be in the form of either financial benefits or service improvements. Better use of IT can release resources and create room and reserves

for a better and more personal service for the individual citizen.

The public authorities' employment of new technology will lead to innovations, quality improvements and efficiencies within public service. The aim is to ensure a better effect with the same resources.

Fulfilment of this target also requires that the essential, well-trained workforce be made available to both the public and private sectors.

1.4 Democracy, culture and participation

The use of IT creates entirely new options for democratic participation, customer contact and citizen involvement. Herein lies a third challenge, namely ensuring there is sufficient competence within the general public, businesses and in the public sector to utilize these opportunities. This also applies to the IT core skills that are necessary for the development of new and innovative services and the use of IT.

The growth in the number of citizens who are connected to the net provides opportunities to digitalize more services and to give citizens access to self-service solutions, information and participation.

The net both supports and contributes to forming culture. The digitalisation of our cultural inheritance, access to The Danish Broadcasting Corporation's archives and immediate access to content on the Internet, means that literature, music, film and art can come alive for and be made relevant to many users.

At the same time digital media and entertainment are some of the decisive factors that can ensure extension and employment of new technology.

The citizens' active participation in employment of the net will be promoted by teaching all Danish children how to use new media and technologies as a simple matter of course. When the digital options are generally introduced in the education system and are actively used in teaching, children and young people will acquire skills and obtain healthy, critical access to using new technological options. At the same time the rest of the population will become ever better at exploiting IT.

Focussed use of digital solutions for competent IT users can generate marked savings and increased options for delivering better service to groups of citizens who have special needs.

1.5 Climate and environment

Our common energy and environmental impact constitutes a fourth major challenge. The use of IT and broadband is an important means in terms of reducing this impact without shedding welfare.

A necessary condition for being able to meet these challenges is a well-constructed and accessible infrastructure. There should be made an effort into solving the common challenges in the area of climate and environment, the education system, public sector and trade and industry.

Employment of IT and broadband is an important part of the solution to ensure better energy usage. In addition, the use of video meetings, work-from-home jobs and modern technology will contribute to reducing the need for transport and thereby ensure a smaller impact on the environment. Finally Danish core competences in the area will be fertile soil for entrepreneurs.

2

Opportunities and challenges in a high-speed society

Not long ago did the Internet primarily consist of text and was reserved for a few citizens or experts, and a modem was the way into the budding information society.

Throughout the 1990s there was an increasing extension of the Internet. The public sector, newspapers and businesses began to participate, and a usable, entertaining and relevant media began to excel.

The transition from reading about the Internet in newspapers to reading newspapers on *the net* has been rapid.

- Technologies have been developed and extended at **increasing speeds** on the net, including connections to the end users.
- **Social and interactive** services are in rapid growth.
- More and more **IT applications** that were PC based or server based **are moving to the Internet – "the cloud".**
- Prices for data transmission **are falling** whilst mobile telephones and PCs are becoming significantly more powerful and cheaper.
- There is a very great **growth in Internet traffic** – not least driven by private users, who to a large scale use the Internet for video services.
- A major change in the manner in which goods and services are exchanged has occurred in the direction of **eCommerce**, which applies to transactions both in the private and public sectors.

Today sound and moving images are a matter of course on the Internet. We communicate electronically with local authorities and use digital signatures when completing our tax returns. We pay bills via online banks, purchase theatre tickets, find holiday cottages and read other users' experiences of the kitchen appliances that we are considering buying. We contact friends and families using social media, share knowledge with others on Wikipedia, read news when we have time and we have the entire world in our pocket now that the mobile telephone also carries the Internet.

The technology only makes sense when it is connected to actual applications with obvious benefits. For the same reason there are major benefits for those who are in a position to transform the technological opportunities into new solutions and to make the technology entertaining, user friendly and useful to businesses and citizens. In this context possibilities for creative entrepreneurs and innovative businesses exist.

2.1 New opportunities for value creation

The building bricks of the knowledge-based economy have undergone a revolution in recent years. Calculation power (processor power), storage (hard disks) and broadband capacity are rapidly increasing while prices are falling. This has enabled a revolution in business models, development and marketing.

Unlike the industrial society, the scarce resources consist in our knowledge, creativity and business talent. IT and broadband has led to opportunities that no one would have imagined just a few years ago.

Knowledge and creative skills are the primary source of value adding in digital technologies. The distribution costs for digital products are very low. A good idea can therefore be realised with modest investments – and if the idea is very good the product can rapidly spread to a global market and challenge existing players and practices.

Skype does not just mean lower call prices but it has also changed the rules of the game. New technology challenges the fundamental premises of the telecommunication industry' long-running business models.

Open source software shares knowledge and products on a global scale – it is a Lego brick for the information society. Open source software is a central part of both Amazon's and Google's business.

The remix culture is a consequence of all current PCs being equipped with tools that enable everyone to edit moving images and sound and to publish creative content that was only available to professional companies ten years ago.

The market is global. For example, the Internet makes it difficult to maintain a business model in which film and TV series are provided regionally at different times and at different prices. This development is challenging existing regulation and business models. For example, intellectual property rights are under pressure.

2.2 The users drive development

Entertainment, games and social media are some of the areas that are driving private demand for broadband and equipment such as new computers, flat screens and games consoles etc.

It is also here many users find motivation to obtain a faster connection and to develop skills and invest in new types of software and technology.

The entertainment area is where one can observe some of the greatest web 2.0 phenomena, such as YouTube, Facebook and Twitter, within the last few years. It is this area that contains some of the very largest businesses. Computer games have historically been an innovative force within the development of computer technology (3D graphics, new forms of interaction etc.). It is also within entertainment and social media that one can observe some of the most creative business user-involving models.

Development within Internet media gives users the opportunity to create content themselves. Many web pages allow the user to supply content in the form of videos, blogs and wikis. Digital solutions are no longer established exclusively based on users but also by users. Web 2.0 represents a development that promotes creativity, new ways of thinking, collaboration and the dissemination of knowledge between users.

One well-known example of this development is the music industry, which has had to adapt to a new reality. Users no longer accept a model in which a central organization in the form of a record company sells CDs to the users. Today music and content must be distributed digitally so that users can create their own remixes. Likewise computer gamers want to be able to modify games and design new tasks etc.

The challenge is how these experiences are transferred to other areas within, for example, education and health.

Danish school children acquire IT skills when they communicate and play games with each other over the net. This raises the question of how schools can save resources and increase motivation by taking this relationship as a starting point.

Similarly many Danish citizens use Netdoktor.dk and other Internet locations concerning health when they experience a health problem. Groups are formed rela-

- The user created encyclopaedia Wikipedia.org was established in 2001 and today contains more than 13 million articles in 200 different languages.
- MySpace, Facebook and YouTube have more than 250 million visitors each month. None of these services have existed for more than 6 years.
- Over 26 million texts are written using the social media Twitter each day. The company is 3 1/2 years old.

ting to different illnesses in which people can support each other and exchange knowledge and experiences. This development in no way renders superfluous a well-trained doctor or that the necessary information should be made available by the public sector. However by using new technology the individual citizen has greater opportunity to take care of his or her own health. This development can also be supported by the strengthening the skills of citizens, including their ability to relate healthily and critically to the information and advice that is available on the Internet.

As online forums become a major source of citizens' access to information and knowledge, it is ever more important that authorities and professionals develop their own online presence and services.

2.3 Political ownership and priority

IT is not just a random technology that is rapidly replaced by something different and more modern. The Internet has caused a paradigm shift to truly occur, which has changed – and will continue to change – the conditions for how we perform business, how we communicate and how we create value in society.

In ten years the Internet has become the central infrastructure for society, which supports a broad spectrum of applications – from teaching and research, via e-commerce, telemedicine and digital administration, to teaching and social communication.

IT in Practice 2009 recently revealed that IT managers find that a lack of IT ability at top management and particularly at a political level constitutes a barrier to the development of public organizations and prevents organizations from obtaining the greatest possible value from their IT applications.

However IT must not be considered a "technology that should just work". Insufficient recognition of the significance of IT leads to a lack of targeted input into optimising services and business procedures. At the same time poor – and thus for individual organizations' very expensive – solutions are accepted.

The High Speed Committee notes in particular that it is necessary to recognize the significance of IT and broadband throughout political and administrative systems. The difficulty of predicting precisely how we can and will use new technology must not limit development.

The utilization of IT and broadband is the basis of Denmark's future growth and welfare. It is thus an area in which we must concentrate and invest.

From the political side we must ensure:

- That the public sector leads the utilization of IT and broadband to a greater degree by consistent use of standardized solutions, by a proven channel strategy in which citizens are given incentives to use digital solutions and by focussing on the major service areas
- That improved framework conditions for trade and industry are created
- That the information and IT skills of Danes are markedly increased
- That there is a massive investment in development and research in IT
- That incentives within the market to perform investments in new and modern broadband infrastructure are ensured so that broadband and mobility are not a limitation
- That the use of IT and broadband is promoted and prioritised in a way that contributes to a better environment and climate.

3

How Denmark will become a high-speed society

The committee's recommendations fall into seven sections, all of which will contribute to realizing the vision of Denmark as a high-speed society.

Having an established modern infrastructure, as well as rapid broadband connections are necessary conditions for Denmark to be a high-speed society. However, it is of greater importance that private trade and industry and the public sector prove capable of using of all new technologies in order to enhance the efficiency of business procedures, promote innovation, create new valuable content and deliver better services.

The recommendations, which must be seen as a whole, will support Denmark as a society in which welfare and a quality public service is provided through improved use of IT and broadband. The recommendations will also support the development of Denmark as a fully competitive society with productivity, financial growth and democracy, where competent citizens utilize the digital options existing in a high-speed society. Finally the recommendations support a high-speed society able to contribute to solving climate and environmental challenges in a positive manner.

The committee has chosen to focus on seven main areas, which will ensure the government's vision of Denmark as a high-speed society through concrete recommendations.

These main areas are:

- Digitalisation in the public sector
- The public sector as a platform for innovation
- Cloud computing
- Information and IT skills
- Environment, climate and green IT
- Research and development in the IT area
- Broadband infrastructure in Denmark

3.1

Digitalisation in the public sector

Denmark typically receives good rankings in international benchmark investigations of digital readiness.

In 2009 Denmark held first place in *The Economists* e-readiness index, which is a measure of a country's ability to transform digital opportunities into social and economic development. Denmark is followed by Sweden, Holland, Norway and USA. The World Economic Forum has also found that internationally Denmark is in the lead with regards to network readiness. The score is based on a complete evaluation of investment climate, regulation, infrastructure as well as e-readiness and application.

However, in other investigations, Denmark's ranking falls just below the high standard. The World Economic Forum places Denmark at international fifth place in the Global Competitiveness Report 2009-2010 and consultancy group CapGemini's *eGovernment Benchmark* 2009 places Denmark at an overall ninth place with regards to digital readiness.

Regardless of Denmark's current ranking the demands for digitalisation are increasing rapidly and constant attention and work effort will be required in order to derive advantage from technological opportunities. A number of challenges already exist relating to public use of IT and new challenges are emerging.

The maturity of IT in the public sector is gradually increasing. In the last five years the focus has gradually changed from the digitalisation of an individual authority's own systems and case procedures to collaboration between the authorities. In order to effectively make use of the new opportunities, this work must be strengthened.

The public sector also faces a continued challenge in getting consumers to make use of digital solutions. For several years many local authorities have offered self-service solutions in a number of prioritised areas, and from the end of 2008 homogenous provision of self-services was finally achieved across all of the county's municipalities in 13 prioritised areas[2]. However, the number of transactions performed digitally only constitutes a small proportion of the citizens' total number of requests made to the public sector. Seven percent of change-of-address notifications occur via digital self-service, and for the majority of other solutions the proportion was significantly lower.[3]

Characteristically, the public sector has no deliberate channel strategy - a strategy for how to motivate citizens to use digital solutions. For example, this could be a form of improved service or financial benefits. In the private sector dedicated work is performed to allocate applications into different channels, such as home pages, telephone contact and personal meetings. A personal application is 30-60 times more expensive for an authority than a digital application[4]. Therefore, an equivalent deliberate strategy by public authorities has great savings potential. Moreover, citizens mostly perceive the opportunity of digital approach as a service improvement, as it can be initiated at the conveinience of the citizen – whenever and whereever.

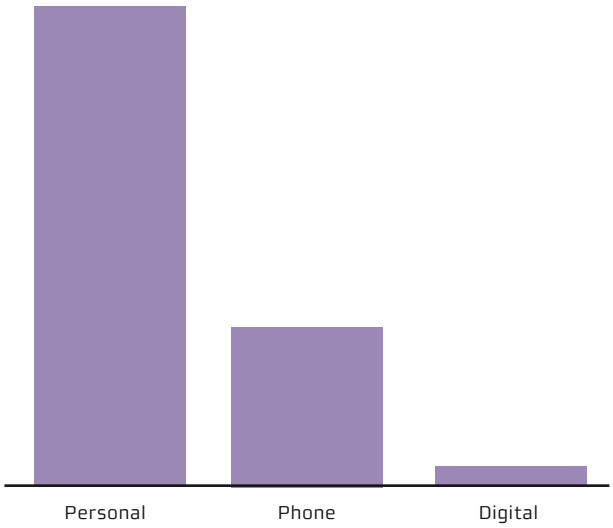
Channel strategy

In order to get its customers to use digital solutions, DSB has increasingly introduced DSB Orange tickets for the Great Belt, which can only be purchased as print-it-yourself tickets via DSB's internet shop. DSB has likewise differentiated the prices of tickets so that it is cheaper to buy over the internet.

Source: DSB

2 Childcare placements, change of address, libraries, notices concerning technology and the environment, maternity leave, change in doctors and health insurance, housing support, child allowance, ordering food for children, meter reading, associations portal, email and ordering passports.
3 From 7 to 70 – Tender for the development of the digital citizens' services in Denmark. CEDI 2009.
4 From 7 to 70 – Tender for the development of the digital citizens' services in Denmark. CEDI 2009.

FIGURE 1
Costs of different forms of applications to the public sector



Sourca: CEDI

A successful channel strategy enables a larger user group to use digital solutions. This simultaneously releases resources, which then preferebly can be used for more targeted effort at users who requires alternative services and to cases of a complexity level requiring user contact.

The public sector will only be able to achieve its goals by, to a considerably greater extent than is the case today, introducing and using digital administrative processes, digital citizen services and digital welfare technology when dealing with core tasks.

Individual authorities must continue their work on digitalisation. There is currently a broad spectrum of collaboration between authorities within the state, regions and municipalities both inter-relative and across the three levels, with focus on creating connection and integration. If the new technological opportunities are to be used in a sensible manner, this collaboration must be strengthened and made more effective.

More often than not, the public sector has a narrow focus on its own systems and services for citizens and businesses.On the contrary, what rarely is clearly presented as a purpose of digitalisation within the public sector is that digitalisation can also change and improve the framework conditions for trade and industry and the citizens.

It should be emphasised, that the public sector establishes the framework conditions for citizens' and businesses' use of IT, including the inter-related use of IT in a wide range of areas, whilst public sector investments often have positive effects on businesses' productivity and development potentials.

Hitherto it has generally been the case that work into digitalisation in the public sector has emphasized the administrative area. Whilst there is still room for improvement within the administrative area, the benefits of digitalisation are only gained when performance improvements in major public service areas occurs. For example, administrative functions constitute only 10 percent of the personnel resources that the municipalities currently control[5].

In order to be able to gain the potentially huge benefits from digital efficiency, a clear managerial focus must be made in this area. It is the opinion of the committee that this work must be performed by the topmost

Better retraining for more – with IT

Today, programmes concerning physical and cognitive retraining where a patient can train and improve at home supported by a relative exist. At the Helene Elsass Center health care providers follow the course of patients with cerebral palsy via an internet connection through which adjusting the treatment and training load is done.

Broadband connections thereby enable far more patients to gain access to regular, adapted retraining. The resources of the treatment system is being put to a better use, and more patients gain access to individually adjusted, daily training.

Source: www.elsasscenter.dk

5 Det Digitale Råd, 2009 (The Digital Council)

administrative management, who can exploit these opportunities by implementing IT in their production and problem solving, and implementing the organizational consequences of constantly increased digitalisation. Only IT competent top management can identify where IT applications add increased value and effect, only IT competent top management can take the necessary decisions and set the course for the organization, and only IT competent top management can form a good basis for decision for its board or at a political level.

Therefore, in order for Denmark to fully benefit from digitalisation and exploit the opportunities to become a high-speed society it is vital that the topmost administrative management and relevant politicians appreciate that the utilisation of digital opportunities within the public sector requires:

- involvement of the users in the digital process through a clear channel strategy,
- involvement of the users in forming public services
- insight into the significance of selecting technology and the organisational opportunities of digitalisation – including understanding of the consequences and new division of work between authorities.

Denmark has potential to develop into a high-speed society in areas where the public precede as a professional and demanding user and supplier of advanced services. Good public digital services will add value and stimulate the population's use of IT and broadband.

However, the services, which are most requested and used, exist within the private sector, spcecifically within the gaming industry. This industry has great expertise and experience in user interfaces, user behaviour and user motivation. The gaming industry in itself has growth potential, but there is also a potential in transferring knowledge of user interfaces and user behaviour from the gaming industry onto the public services.

Through the increased usage of IT and broadband the public sector is given an opportunity to play a new role compared to its previous role, which was limited to being a service and welfare supplier. New tendencies such as web 2.0 and interactive service interfaces, where citizens and businesses interact in forming and compounding the public services, will strengthen the democratic process. Digital interaction with the citisens correspondingly is central in making the supply of public services more efficient.

Chronic illness

Patients with a chronic illness require long-term treatment and care and/or special rehabilitation procedures. Foreign investigations have found that up to 80 percent of total expences in health care systems is spent on people with chronic illnesses. Many citisens with chronic illness also suffer from other illnesses.

Source: Danish National Board of Health

The costs in connection with a chronic illness (chronic obstructive lung disease, diabetes or cardiovascular disease) typically range from 50,000 DKK to 80,000 DKK per year per patient. A significant part of the costs does not fall into of the health care service and cover municipalities' special input into nursing homes and residential services, transfer incomes and home care.

Source: Capital Region

User involvement

On the Scandinavian breast cancer list (http://www.scan-bc-listen.dk) women with breast cancer can exchange their experiences and offer each other care and support, e.g. how to deal with family members and one's surroundings when suffering a critical illness. The Internet gives patients with extremely rare forms of cancer the opportunity to exchange information and experiences across countries and treatment systems.

Another example of user involvement is Netdoktor.dk's Babyklub, where one can find information and ask questions about pregnancy and illnesses in small children.

There is a broad spectrum of specific service areas in which the public sector can lead with new services. Specifically digitalisation creates opportunities in major public service areas such as elderly care and nursing. Many projects already exist, yet it remains an ongoing challenge to consolidate the results of these projects into actual operation on a major scale.

Health is an area of great importance to the individual citizen. Patients and relatives increasingly demand intelligible communication, individually suitable service access and the opportunity to get expert advice or a "second opinion". In particular the involvement in the indivudual's well being means that patients and relatives are amongst the most motivated groups of citisens when it comes to adopting new technologies. This is exemplified in some of those online communities relating to specific illnesses and treatment courses that have in recent years appeared on the Internet.

The accessibility of such services informs the citisens on how to prevent illness and gives the citisen a basis for evaluating when to call a doctor or the emergency services.

At the same time the development in citisens' approach to health and treatment provision has created a movement within the health care service, where patient contact and treatment courses are planned with the individual patient as centre – in this context, the opportunities that new technology provides can play a significant part, e.g. when dealing with chronic illnesses. For example, it may be appropriate to make use of video consultations in outlying areas or to have possible access to use to include knowledge of the nation's – or the world's – leading experts. Furthermore, remote monitoring and self-monitoring of selected patient groups reduces travel time for individual citisens and thereby ensures better use of resources in the health care network.

There is a wide range of fragmented experiences. A large number of successful pilot projects have been performed in hospitals. Within the ABT Fund (the fund for Applied Citisen Focussed Technology) means have been granted for many new projects focusing on workforce saving technology and alternativ work methods and organisational forms. The ABT Fund supports an additional 44 different projects. The Finance Act for 2010 agreed to grant almost 126 million DKK for 25 specific projects in which new technology will be used to create better welfare.

In addition, almost 120 million DKK has been assigned to the Shared Medication Record project in which all citisens will be assigned an electronic medication record on a central database, which displays patients' current medication. All prescribing doctors will be immediately able to create a record of current medication in their own systems – regardles of whether it concerns

Digital care

Telemedicine is used in the South Denmark Region in the treatment of injured patients. The nurses can periodically take pictures of injuries in the patient's home and transfer them using a mobile telephone or computer to a doctor and hospital, where specialists can evaluate the images and advise on further treatment regardless of time or place. This avoids unnecessary waiting time and allows the best treatment for the cause of the injury to be rapidly selected and the treatment continuously adjusted.

Source: http://www.sygehussonderjylland.dk/wm229379 (visited 23rd October 2009)

In Region Fyn some patients keep a "patient suitcase" in their homes. The suitcase contains medical equipment and equipment for video communication with a doctor and hospital. The patients can monitor their illness in dialogue with health personnel. This is particularly relevant to patients who require continuous contact with a doctor/hospital. The number of bed days in the hospital is reduced and the patient can receive better care at home.

Source: ITEK: Better municipalities and regions with IT

hospital admission or general practiceconsultation. The information on the medication record will be split between the parties in the primary and secondary sector who are treating the citisen. The individual citisen is to be able to view their medication records via the Internet.

Other projects that intended for national implementationare being supported. Among these is a project to reuse administrative patient data in up to five selected disease areas.

These measures towards national extension of effective solutions are vital if Denmark is to be able to fully benefit from digitalisation. Consolidating the results of the many projects into actual operation on a large scale continues to be a challenge. In this context it remains a challenge to gain funding for national implementation, as the connection between where funds are spend and the resulting benifits.

The committee believes that systematic work should be performed within the public sector into the national extension of successful digital projects and promotion of public sector data and services in a standardised and structured form parallel with working on individual projects in the ABT Fund. This will create a foundation for innovation by citisens and businesses into developing new digital services that support and extend public service provision whilst also creating workforce savings and being more efficient.

Digital solutions can support the elderly in their own homes

- Training and treatment course in the home via games consoles or connection to retraining centre and experts.
- The intelligent refrigerator, which uses RFID technology to check whether there is a lack of food or if food isn't eaten enough and then informs the home nurse.
- Heating systems that pay bills themselves via remote meters.
- Household machines that can order repair when they break down.
- Remote controlled systems for opening and closing windows and doors.
- Personal alarms that remind patients to take pills and remember personal agreements and similar.
- GPS systems that give piece of mind by helping the elderly home from unknown places and making it easier to for them to be found in situations where then cannot return home themselves.

Source: The Digital Council

Recommendations for digitalisation in the public sector

- **Cross public sector coordination and standardisation in the IT area.** The current focus on coordination and standardisation in the IT area should be maintained and intensified to ensure common, reciprocal solutions.

- **Promoting the use of public sector digital solutions.** Public sector work should be more focussed on a deliberate channel strategy where citisens are motivated to use the digital solutions, for example improved service or financial benefit.

- **The public sector must be a professional and demanding user of IT.** Focus is required to ensure that the public sector's IT services are efficient and of high quality, and that Danish IT suppliers compete at an international level. The topmost administrative and political management must have greater understanding of the utilization of digital opportunities in the public sector – particularly in the major service areas (social, health and education areas).

- **User involvement.** The users must experience digital services as an improvement in service. At the same time users are a major innovation resource. The public sector must have a deliberate strategy for user involvement.

- **Digitalisation and coordination in health and social areas.** Work must be performed into increased use of telemedicine in the primary health service and into treatment in patients' own homes, home monitoring and individual care. There is generally great potential in coordinating the primary health sector's activity's with the hospital sector in order to optimise data capture during the nursing and disease course.

3.2

The public sector as a platform for innovation

Many of the technological, social and commercial developments that are occurring in the IT area in current years are common to both the public and private sectors. Within the public sector this is known as "Gov 2.0" or "government as a platform".[6]

Gov 2.0 covers three tendencies:

- Open, flexible technologies (open source, open standards and machine readable structured data) as flexible building blocks for constructing a net location etc.
- Web 2.0 is a trend based on media such as Facebook, YouTube etc., in which social interaction occurs and the user creates value in the form of content whilst the supplier makes the platform available.
- Democracy: User influence and transparency. Accessible data makes public authorities more transparent to citizens, businesses and organisations. The Internet makes it easier and quicker to find information.

One significant consequence of Gov 2.0 is that it provides closer integration between the public and private sectors. The public sector becomes a platform for innovation by releasing data, open interfaces and infrastructure. The private sector can use this platform to independently develop and provide services.

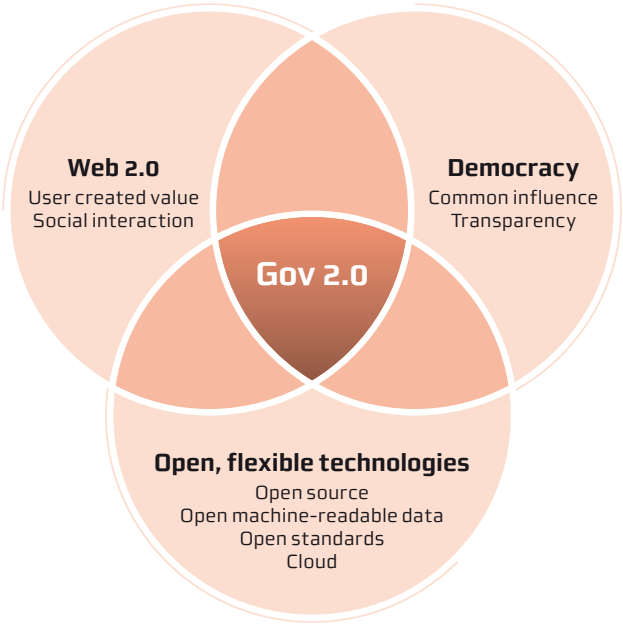
The movement of IT in the public sector towards Gov 2.0 is an important prerequisite to the development of a high-speed society.

Private parties who develop and provide public services

Even though examples of data made available on the Internet in a machine-readable form are few, development in this area has occurred in the USA via the net space data.gov.

6 www.techcrunch.com/2009/09/04/gov-20-its-all-about-the-platform/

FIGURE 2
Government 2.0



Source: National IT and Telecom Agency

Findvej.dk

Findvej.dk is a net space that together with Google Maps provides information on food Smiley's with links to the Danish Veterinary and Food Administration's inspection reports as well as a summary of collective traffic stops in Denmark. Both data sets are made available to the public and findvej.dk has used them to create an overall map that shows the name of the stop and a map showing the assigned Smiley's and their geographical location.

Source: www.findvej.dk

Although the value of citizens and trade and industry having free public access to data is difficult to assess, the committee has clearly evaluated that its value vastly exceeds the current public earnings selling certain types of public data such as CVR data, registration data and map data.

The public sector is currently responsible for the overall development of citizen-targeted services. This concerns everything from the underlying IT system and data collection, handling and maintenance to the development of the user interface. Services can for instance be presented through the portal borger.dk or on a communal net space. However, as this may be a sensible approach in certain cases, it is not always the best solution.

New York State Empire 2.0 and NYC Big Apps

In summer 2009 the state of New York announced the plan, "New York State Empire 2.0". The aim of this plan was to use new social media to promote collaboration, participation and transparency with citizens and businesses. One of the first initiatives is a web forum where citizens and employees in the administration are invited to propose and discuss how the state can use Web 2.0 is the best possible way.

New York City has decided to hold an annual competition ("NYC Big Apps") where data will be made available and citizens and businesses will be asked to develop software that is useful for New Yorkers.

Source: www.cio.ny.gov/News/Press_web20.htm (visited 16 September 2009)

NYC, press release, 29 June 2009

Folkets Ting (The People's Parliament)

Folkets Ting is a privately established alternative to the Danish Parliament's official web space. Folkets Ting draws on the same data as Folketinget.dk but releases texts, data etc. in a different way and gives users the opportunity to comment and debate legal proposals and parliamentary debates.

Source: folketsting.dk

Public/private interaction should evolve into a new form through a higher level of private businesses involvement as (co-) developers of citizen-targeted services, where development happens within businesses that already have a user group and competencies concerning usability etc.

New collaboration forms in the development of citizen-targeted services are conceivable. Banks could for instance integrate public sector invoicing into their Internet banking systems. Entrepreneurs could integrate a function for building permit applications etc. This would result in self-service solutions having the public sector providing data and infrastructure, and subsequently businesses would develop the solutions that citizens use on competitive conditions. The advantages here are that the public sector avoids expenditure to develop the solution and that businesses can benefit from providing solutions to citizens.

It is not a central matter whether individual programmers are paid directly by the state or by an external development house working for the state. What is important is who has the initiative for innovation, for example, if businesses can compete for services that are based on public data. For the public sector the opportunity lies in abandoning the tradition of building IT solutions from top to bottom (e.g. maps) and instead use existing commercial map services as a cost beneficial alternative. In the future this will be a case of how one can ensure the most possible innovation, content and service for money expended.

The opportunities are not limited to mere data on traffic and roads etc. but also include digital content in the form of sound and images. For example, The Danish Broadcasting Corporation's (DR) archives are very relevant as the raw material for digital teaching aids in state schools. The archives can be made available to private businesses that carry DR on new platforms, media or contexts. In this way openness and innovation can also help in storing and extending the cultural heritage of the nation's museums etc.

Open Data Innovation Strategies

In November 2009 the Ministry of Science, Technology and Innovation held a competition for ideas on *"Open Data Innovation Strategies"* ("ODIS"). The aim of the competition was to find good examples of how public data can be used for many more purposes and by many more people than it is today.

Source: National IT and Telecom Agency
digitaliser.dk/news/417465 (visited 24. november 2009)

Standards, infrastructure and context

In order to support development towards a high-speed society it is vital that the public sector's use of IT is based upon openness, innovation and competition. Openness (open standards, open source, open data) means that it is possible for others apart from the state itself to provide services. This strengthens the opportunities for innovation.

Continued digitalisation in the public sector requires greater coordination and standardisation than before. One way to achieve this is to use open standards. Open standards enable data and components to be exchanged between public (and private) solutions.

There are also benefits to be gained from the modular construction of IT systems in the form of lower prices and simpler upgrading and reuse of sub-components as required.

Common interfaces and open standards are therefore prerequisites for releasing the potentials of high-speed society.

Unexploited ways of making Danish trade and industry more efficient

There are 250,000 small and medium sized businesses in Denmark. Traditionally they have actively promoted digitalisation, e-commerce and access to broadband. But there are still advantages to be exploited.

The advantages include for instance the way in which businesses submit reports to public authorities. If reports can be submitted digitally, having the IT systems of both the businesses and public authorities communicating with each other ("system-to-system integration"), there will be significant potential for savings in terms of reduced time consumption as well as an reduction in errors caused by manual entering.

In this respect the public sector can promote positive development by promoting the establishment of a fundamental IT infrastructure for this type of report. It is then up to the market to add content to the framework and provide business solutions, which uses the infrastructure, and then aim these at the small and medium sized businesses.

A successful example of this approach is NemHandel, where the state is leading the development of IT infrastructure for exchanging invoices over the Internet. In addition to IT infrastructure, private businesses provide services to their customers, for example accounting software. In this way the public sector promotes increased digitalisation as well as ensuring that IT investments benefit both private businesses and public authorities.

Recommendations for the public sector as a platform for innovation

- **Displaying public data.** Public data is an innovation resource for citizens and businesses. The public sector must continuously extend the amount of publicly available, machine-readable data in order to support the innovation and development of new services for democratic or commercial purposes. The committee recommends that as an extension of the current "Open Data Innovation Strategy" project, work is targeted at private players being able to use public services and produce net spaces and other user interfaces to display public data and data capture on behalf of public authorities.

- **Open, flexible technologies.** The use of open standards, open source and open machine-readable data supports innovation and competition. Simultaneously it supports freedom of choice in suppliers and competition in IT services.

- **Public information should be given where it is relevant, and public data capture should occur at the source.** IT in the public sector should be open IT. This means that the public sector should allow more private businesses to display and use public data. Where transactions between businesses or between businesses and citizens necessitate giving information to the public sector, it must be possible to gather and transfer the data directly to the public sector data as part of the private transaction.

- **Digitalisation of Danish trade and industry, and savings via better and more effective IT.** An ambitious plan should be formulated to promote an extended, cost effective and robust business IT infrastructure. The public sector should lead by developing infrastructure components. The specific formulation should occur in close dialogue between trade and industry and the state.

3.3
Denmark as a Cloud nation

As opposed to conventional IT, which is sold as a product subsequently owned by the buyer (which is the case with servers and software), Cloud computing is IT offered as a service delivered on a pay-per-use scheme via the Internet. This may be a subscription to an email service or a subscription for access to server capacity that supplies computing power and storage .[7]

Cloud computing is a form of outsourcing, however:
- The ability to pay for computer power, e.g. with a credit card, without any prior agreement is new.
- The ability to purchase elastic computing power and only pay for that, which is used, is new.
- Computing resources being provided at such low prices is new.

The benefits include:
- Short lived contracts: This may be hours, days or weeks whereas traditional outsourcing contracts typically run over several years. Short contract periods provide greater flexibility in connection with software development where one requires temporary test environments etc.
- On demand: Up scaling/addition of resources occurs within a few hours – whilst traditional outsourcing typically requires a notification period of several weeks and where it might not be possible to subsequently "scale down".
- No start up costs: The costs of capital investment and installation are included in the usage cost.

It is the committee's evaluation that there are significant both economic and environmental benefits in increased use of cloud computing. Cloud computing may be advantageous to opening the way for start up businesses by reducing set-up costs.

Being characterised a large and professional user, the public sector can contribute to opening up the way for an increased use of cloud computing. The committee therefore proposes that visions be shaped for use of cloud computing, including ensuring a basis for savings in both the public sector and in private businesses.

7 KL and National IT and Telecom Agency "Cloud computing in the public sector – a debate proposal" (July 2009).

Virtualisation is a technique in which one consolidates many physical servers into fewer larger servers and can thereby draw on a greater, shared server capacity – either in existing server space or in common data centres. This enables allocating capacity to current requirements. Virtualisation has been in use for several years just as traditional data centres have been used for some time.

Cloud computing is supplied as a service over the internet. A cloud computing service is characterised by it being supplied and paid for as required and used, its transmission via the internet, delivery from a platform of common computer resources and that it can easily be scaled up and down as required. There are cloud services for different needs:

- "Software as a Service": Software that is sent via the Internet. Examples: Web based email programs (e.g. Hotmail), net-based text handlers (e.g. Google Docs), online photo albums (e.g. Flickr) or file allocation (Dropbox.com).
- "Platform as a Service": Platform with a range of fundamental services that the customer can administer himself (e.g. "Hosted Exchange" as an alternative to having one's own mail server).
- "Infrastructure as a Service": Network, computer power or storage where the customer can administer and develop software or applications, store data etc. (e.g. Amazon AWS). The user has a virtualised environment that can be moved to a cloud based solution.

Inspired by the definition created by NIST – National Institution of Standards and Technology

Cloud based collaboration in schools on Fyn

In the municipality of Odense the school children have been given the chance to use net-based text handling in the form of Google Apps. The programs have been tested in 4 and 5 classes over a period of time and due to their success it has decided to provide this service to all 18,500 pupils in the municipality. The leader of the project stresses that net-based text handling meets the needs of pupils and also enables pupils to collaborate on common documents.

Source: DR Nyheder, 16 November 2009: "Google Apps captures Funen"

Increased use of cloud computing will lead to increased demand for secure high-speed connections for businesses, public authorities and private households.

An investigation commissioned by the High Speed Committee from IDC has demonstrated the significant potentials of using cloud computing:

- Servers and data centres in businesses and in the Danish public sector currently consume 864 GWh of energy per year. This is more than double the quantity of energy that is used for street lighting in Denmark[8].
- If all servers in Denmark are virtualised to the highest possible degree – in private or shared data centres – it will be possible to reduce energy consumption by up to 33 percent compared with today.
- In addition to the benefits from lower CO2 emissions, it will be possible to reduce the costs of electricity and hardware by 22 percent in 2013, which is equivalent to more than half a billion kroner.
- By using commercial cloud services further rationalizations may occur that will allow power consumption to be reduced by up to 55 percent compared with today.

8 IDC: "Potential Server and Datacenter CO2 Savings in Denmark", October 2009, prepared for the High Speed Committee.

Cloud computing can already be used for a range of solutions, however it will only be possible to fully benefit from cloud computing once a number of challenges relating to IT security and privacy, interoperability, new agreement models and business models have been solved. On the plus side, the more effective potentials and environmental benefits of consolidating server parks must be examined in greater detail.

Cloud computing is an area in which the public sector can lead and gain experience based on specific projects – for example within schools, universities and selected areas in the public sector. An extension of this may be the issue of business targeted guidance concerning the use of cloud computing.

Guidelines concerning formation of contract in the public sector in cloud computing area should also be composed. The ICT council under the Ministry of Science, Technology and Innovation has recommended that there is a need for standard contracts for IT services able to take innovation into account. The committee supports this recommendation.

Innovation using cloud computing

New Danish innovative businesses are already based on cloud computing. PodcastMachine.com is a business that provides complete solutions for distributing podcasts. The business does not own a server park or office premises but is based on cloud computing.

Discoveries and Monuments in the Cultural Landscape

The interactive map "Discoveries and Monuments" is an example of a "mash-up" where one can find the location of graveyards and churches etc. Google provides the map and the data on the monuments originates from the Heritage Agency of Denmark's database of over 150,000 culturally historic locations. Teachers and pupils in state schools can use the map.

Source: e-museum.emu.dk/museum/public_showmap.do

Recommendations for Denmark as a Cloud nation

- **Denmark as a leading cloud nation.** The public sector should massively invest in cloud computing. Due to its size, the public sector is an attractive customer for suppliers of cloud computing, who therefore have an interest in helping to solve challenges relating to privacy, data security etc.

- **The public sector should implement projects that use cloud computing.** A focus should be placed on collecting experiences and giving guidance on the use of cloud computing, including ensuring clear and beneficial subscription conditions/standard agreements and new paradigms for security etc.

3.4 Information and IT skills

The idea of a high-speed society can only be realised with a high basic level of information and IT skills (hereafter IT skills) in the wider population.[9]

In addition, general IT skills are increasingly necessary as more and more of society's central processes are transferred to digital platforms. This includes news coverage and the actual political decision processes.

In February 2009 the European Council passed a recommendation on e-Democracy[10] under which the member countries were recommended to use new digital channels and technologies to strengthen democracy and public debate. A significant proportion of news distribution and political discussion in online media already takes place more so than in printed newspapers and their comment pages, which in principle gives everyone the opportunity to have their say – everyone able to use IT. A lack of IT skills, therefore, risks becoming both a social and democratic problem if not sufficient extra effort is made to ensure that the entire population has the necessary skills.

Concurrently there is a need for both highly trained IT professionals with special key competencies and a need for professionals within other areas with good IT skills who are in position to develop and innovate IT. This is essential to Denmark's future growth and competitive ability.

The population's general IT user skills

General IT user skills must today be considered to be basic skills on the same level as being able to read, write and count. The entire population should be able to search for and use information from the Internet and create their own content by being able to share images with others on the Internet. Online users should be able to act critically and ethically in social online services.

An investigation by the EU Commission shows that people with merely basic IT skills both earn more and have a greater probability of being in employment than people without any IT skills.

Source: Vienna Study on Inclusive Innovation for Growth and Cohesion: Modelling and demonstrating the impact of eInclusion, 2009.

It is of value both to the individual and to society that everyone can subscribe to online training use public web pages and Internet banks and send emails etc. In addition Danish citizens should know how to act in a safely and secure on the Internet in general and when making purchases.

However, the ICT barometer in 2009[11] showed that approximately one fifth of the population between 16 and 89 years have weak IT skills as an additional fifth have never used a computer. The measurement also shows that the problem is not isolated to adults but that eight percent of 16-24 year olds also have weak IT skills. These results must be improved if Denmark is to realize its vision of becoming a high-speed society.

State schools and youth training must lay the basis for citizens' fundamental skills and thereby also for citizens' foundation for participating in a high tech society. A targeted effort is therefore required with input into early IT based learning throughout the education system.

9 The concept is intended to include both technical competencies and competencies in using content critically and constructively.
10 wcd.coe.int/ViewDoc.jsp?id=1410627
11 National IT and Telecom Agency's IT barometer, 2009.

This will place considerable requirements on:

- Teachers' skills,
- Educational activities,
- The development of new teaching material,
- The physical limits in the form of the computers and the Internet connections that are made available to the pupils[12]

In Aalborg the mobile telephone is used interactively to teach history. The game DACMAN is also used to communicate the local area's historic cultural heritage. The participants are actively involved as they follow a trail on their mobile phones whilst moving around a factory area. DACMAN was developed in collaboration with a number of private and public players.

Source: historie-online.dk

This effort will require new IT based teaching material, including material developed specifically in terms of teaching and material that is developed for other purposes but can be included in teaching (e.g. both educational games and commercial games). The introduction of different types of games into teaching may have a powerful motivational effect on pupils and make teaching both more effective and entertaining.

IT is creating a new relationship between teachers and pupils and enabling us to reflect on teaching and the teaching course in entirely new and qualitatively better ways. At the same time it enables teachers to collaborate and share knowledge between each other (exchanging teaching courses and learning resources) and between schools and homes. Today IT is used to very varying degrees and often only as a supplement to general teaching. Investigations indicate that IT only seriously has an effect once it is integrated into individual subjects. IT should therefore be integrated into subjects and a focus should be on the subject and educational benefits of using IT in teaching. Finally the development of IT based subject educational activities in collaboration between practitioners and IT educational researchers should be promoted.

In order to realise the above-mentioned objectives, teachers must master the new teaching aids and have a greater understanding of the general educational and subject specific potential of such aids. Teachers and instructors in state schools and youth courses should therefore focus on IT skills and IT based subject activities.

In order to support the use of IT based teaching material, stable and well functioning IT must be provided in teaching locations. This will allow consideration of the need for remote operation of IT that is adapted to the schools and also functions as an outside service. This will help to create the basis of a coherent IT infrastructure, where students and teachers have access to digital teaching plans, evaluation systems and teaching material. For example, this may include IT based evaluation systems that are formed as a "digital teaching log" with user control and logging of performance in e-learning games.

In short, the effort takes form of pilot projects with the purpose to develop and demonstrate best practice. The focus areas are teaching in combination with remote training (blended learning), use of computer games and "edutainment".

One particular challenge concerns young people's knowledge of private life aspects of social media. Teaching classes on intellectual property rights and public/private limits on the Internet based on young people's actual use of Facebook etc. should therefore be consi-

The Finance Act in 2007 allocated approximately DKK 200 million to the Ministry of Education to support the development of IT based teaching and training media, the purchase of computers for state schools, retraining of teachers in vocational courses and cross IT development throughout the entire education sector, including extending schools' common access to the Internet and associated services.

Source: The Ministry of Education

12 news.bbc.co.uk/2/hi/technology/8309583.stm

dered. Young people could provide specific experiences and opinions, and the teacher can supply a critical review of Facebook's user conditions and what is appropriate and legal when uploading images.

In order to establish operational targets for pupils' IT skills at different levels and to ensure international comparability, Denmark should participate in international work on the development of standards for IT competency purposes. For example, this may be done by participating in ICILS work (International Computer and Information Literacy Study). A decision on this will be made in the spring 2010.

A general increase in the population's IT skills will not solely occur via input into the formal education system, as the vast majority of citizens currently without fundamental IT skills left school many years ago. The formal system cannot ensure ongoing qualification or maintenance of IT skills in those who only use IT to a limited extent in their everyday life following the end of education. This challenge is particularly great with regards to older population groups who do not participate in formalised higher education or employer paid courses.

A deeply rooted effort in which public and private participants closely collaborate to strengthen skills within the broader population is therefore required. A good starting point for this is the already established "Learn More About IT" network[13], which is a national collaboration participated in by a range of public and private organisations. In addition to extending specific IT training, the purpose of the collaboration is to strengthen Danish citizens' knowledge of digital opportunities and to inspire the population to learn more about IT in order to ensure that an increase in the competence of all layers and groups in society occurs.

At the same time it is important to recognize the value of IT learning that takes place in the citizens' more private behaviour, e.g. when purchasing on the net, through games, the use of social media and communication with family and friends. The opportunity for competence development through this entirely informal form of learning should be considered in evaluations of the fundamental competence development of the population.

The professional IT skills

In both trade and industry and in the public sector there is a great need for *professional IT skills* as a prerequisite for being able to exploit the opportunities of IT and to promote development.

This applies to the more broad IT competences that are relevant to people who are trained in other areas (e.g. nurses, teachers, school teachers, engineers etc.), and who need to use and integrate IT in their work to a certain extent. This also applies to the more specialised IT skills that the individual gain via specific IT training (e.g. computer science, informatics, data technology, multi media, software development, design etc.).

Professional IT skills are necessary in order for businesses and society to obtain the full benefit from technological development. Investigations show, for example, that investments in IT do not in themselves lead to growth or improvements in efficiency if the organisation's employees do not have the necessary skills to use, adapt and integrate the solutions into the organisation's work procedures[14]. Simultaneously the user can now optimise the system of many applications in order to improve work procedures and enable more complex, innovative and user specific use of IT.

These skills are not only necessary in connection with actual IT environments but are generally necessary in the vast majority of subject areas. There are only a few existing industries that will not benefit from an increased use of IT. In order to obtain full benefit employees must not be limited to use programmes but also have the skills to use them in a subject specific way and to adapt them to specific usage situations.

IT must therefore be generally integrated into education and into the content of all courses. This is relevant, for example, in medical studies, nurse training, teacher training and in social sciences. It will likewise be relevant to vocational courses and contribute to creating a foundation for innovation and development in the IT utilisation in different subject areas, which will improve the use of IT in trade and industry.

13 www.itst.dk/e-laering-og-it-faerdigheder/ler-mere-om-it
14 Vienna Study on Inclusive Innovation for Growth and Cohesion, 2009.

The LIFE faculty at the University of Copenhagen has used the study support platform CampusNet from 2002 to February 2009 as a communication platform for reports, file sharing, calendars and evaluating courses. The solution has simplified administrative routines for conducting teaching. In addition LIFE held a 100 percent online course "Climate Change, Impacts, Adaptation and Mitigation – CCIAM" in spring 2009. The course was interdisciplinary with teachers from LIFE, NAT and JUR as well as Denmark's Meteorological Institute, UC Berkeley and the Australian National University. 60 students from 25 different countries participated on the course.

Source: Note on E-learning and IT supported training at LIFE (September 2009)

In addition there is a need for increased focus in specialised IT training in Denmark. Denmark trains too few IT candidates compared with other European countries and lacks, therefore, a competent IT workforce. Compared with other OECD nations it is vital that Denmark deals with its educational backlog. The challenge for Denmark is amplified by the massive and targeted promotion of IT skills in countries such as India.

Both trade and industry and the public sector require professional IT skills. As part of the effort to promote the uptake of IT in higher education, focus should also be on the reputation of IT amongst young people in order to strengthen interest in higher education IT courses. This will involve increasing understanding of the aims of IT courses and what can be achieved as an IT professional. Upper secondary education should also place a greater focus on IT and support should be given to schools that offer computer science classes.

If the full prospect of IT is to be realised, special skills in the development and innovation of organisations via the use of specialised IT solutions are required. The committee finds that there is a great need for specialists with skills within IT and organisation development, and so courses within these areas in particular should be created and marketed.

Specifically the committee believes that the Ministry of Science, Technology and Innovation and the Ministry of Education should prepare a strategy and an action plan before 1st July 2010 that ensures that the scope of Danish IT core skills will be extended so that Danish public sector IT research can support private IT research and development. In particular the action plan should address how the chain from secondary schools to upper secondary schools to higher education courses can be strengthened so that sufficient talent is recruited to IT specific and interdisciplinary IT courses at universities.

Recommendations for information and IT skills

- **Promoting the wider population's IT skills.** The existing "Learn More About IT" network should be strengthened and information and guidance on the use of IT should be given via channels close to citizens such as libraries.

- **IT in state schools and youth courses.** The use of IT in teaching should be promoted by stimulating teachers at a managerial level and through retraining and support for developing IT based computer science courses.

- **Pupils' IT skills.** A target should be set for the pupils' information and IT skills via IT target and subject descriptions. Upper secondary school courses should be established with a focus on IT and support should be given to schools that hold computer science classes. In order to focus on IT competence levels, Denmark should participate in the international comparative investigation ICILS.

- **Strengthening teachers' IT subject and IT based subject educational skills.** Teaching courses and higher educational courses should be adapted and include a greater command of IT and IT based subject education than is the case today. Funds should therefore be allocated to the development of IT based teaching materials for state schools and youth courses.

- **Teaching material.** The development and production of innovative, IT based teaching the education system acting should support materials as a market for private manufacturers of digital teaching aids, learning games etc.

- **Infrastructure.** Development of a coherent IT infrastructure with standardised digital teaching plans, evaluation systems and teaching materials should occur. In addition stable and professional IT operation in state schools and on youth courses should be ensured, including the establishment of rapid broadband connections and wireless coverage.

- **Professional IT skills.** IT should be integrated in all higher education courses so that a foundation is created for innovation and development of IT application within different subject areas.

- **Specialised IT skills.** More IT subject specialists should be trained to a high level at universities. Over the course of the next five years Denmark should increase its output of IT candidates to become one of the three best placed European countries training such candidates. Before 1st July 2010 an action plan to strengthen Danish IT core skills should be prepared in collaboration with the Ministry of Science, Technology and Innovation and the Ministry of Education.

3.5

Environment, climate and green IT

Green IT can make a significant contribution to solving the climate challenge and is therefore of great social value.

Due to IT being responsible for two percent of global CO2 emissions it can help to reduce the remaining 98 percent. Green application of IT and broadband can contribute to reducing energy consumption and thereby reduce our CO2 impact. At the same time, green IT can also contribute to efficiency that creates financial benefits in the following three areas: intelligent traffic systems, energy and video conferencing:

Intelligent traffic systems

Technology can improve traffic throughput, increase traffic safety and reduce unnecessary environmental impacts. In particular digital infrastructure can support intelligent traffic systems and ensure a more flexible throughput of traffic, e.g. with variable speed signs and dynamic route guidance. For example, intelligent digital support may be beneficial when introducing a fine-meshed driving fee system.

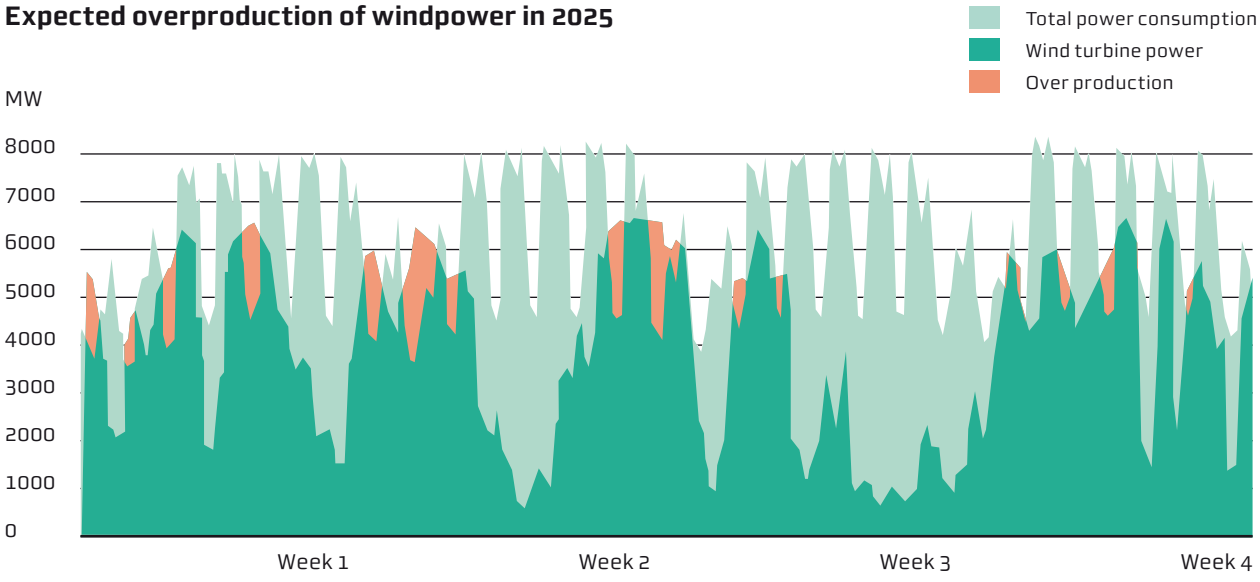
Energy

The current electricity system in Denmark is "unintelligent" in the sense that the electricity consumed does not adjust to current production from windmills etc. Electricity production from windmills fluctuates and also occurs at night when consumption is low. Efficient use of increasing volumes of wind energy in the future will require the ability to use electricity as it is produced. Otherwise this may lead to the waste of wind turbine energy and limitations on the use of renewable energy sources. An intelligent electricity system will create far greater accommodation between consumption and production with less wastage and better use of renewable energy as a result. An intelligent electricity system uses digital technology to distribute the energy in more optimal ways in relation to both supply and demand.

The curve below shows how the considerable quantities of wind turbine power that we plan to establish in 2025 will lead to numerous periods of over production of wind power. A further increase of the wind power capacity will worsen the problem. We therefore require more flexible electricity consumption than exists today.

FIGURE 3

Expected overproduction of windpower in 2025



Source Energinet.dk

There is a great need for incentives and technology that can ensure that consumers adjust their electricity consumption in an appropriate way in relation to the supply of renewable energy. The market price currently fluctuates in relation to supply and demand. However a "blanket" of fixed prices and tariffs limits users' incentive to act flexibly. More flexible tariffs and charges could, for example, make it more expensive to use tumble dryers and washing machines in core impact periods than in periods when there is an excess of renewable energy in the electricity network and prices are low.

It must be cheaper to use electricity in windy periods and when consumption is low, and the user must have a clear picture of when these periods are. The intelligent electricity system will inform when there is an excess of renewable energy in the network and the energy price to the consumer is therefore cheaper. The technology could exist in intelligent systems within the consumer's premises where the systems can an activate energy consuming apparatus when the electricity price is low. An electricity meter that can measure consumption over short intervals will also be installed. Thus the consumer would be able to benefit financially from acting flexibly.

Villa Watt

Villa Watt is a demonstration home that is equipped as a standard home but with IT solutions that make the home energy saving and intelligent. The purpose of the Villa project is to find out how we can save 30 percent of the energy in a home whilst improving comfort. The Villa Watt project is being conducted for the Ministry of Science, Technology and Innovation, the Danish Electricity Saving Trust and the IT industry. The VillaWatt.dk web page has been created to reach the general public. It contains advice on intelligent and energy saving measures in the home. The intention is for the residence to act as a basis for new ideas and for smaller developers of green technology.

Kilde: villawatt.dk

The intelligent electricity system presumes constant exchange of digital information between the electricity exchange, electricity trading companies, Energinet.dk – the business responsible for the electricity system, and between electricity trading companies and the consumers and digital units in consumers' homes. Digital and robust infrastructure to support the total volume of transmitted data must therefore be extended.

The intelligent electricity system will notify the washing machine of when there is an excess of capacity in the net and electricity is cheaper and comes from renewable energy sources. And so, it is vital that there are good connections between the intelligent electricity system, meters and units.

Videoconferences

Increased use of virtual meetings rather than physical meetings can save money, time and reduce traffic impact and thus CO2 emissions.

The committee sees great saving potential in the broad application of video conferencing, and the committee therefore considers it to be an important area for political focus. Video conferencing should be widely used in areas and functions where a large number of meetings, transport and journeys currently occur.

Norway[15] has calculated the savings potential in this area. It was calculated that up to approximately 140,000 employees in the state administration made 523,600 journeys in 2008, of which 32 percent were trips abroad. In total approximately 521 million kilometres were travelled. Using video conferencing can reduce this kilometre figure. If just 1/5 of the journeys were replaced by video conferencing, it would be possible to reduce CO2 emissions by 12,650 tonnes each year. In addition the state would save approximately 290 million Norwegian kroner in flight charges.

In comparison the Danish state spent over 200 million Danish kroner[16] on flights in 2007. If introducing the use of video meetings could reduce 1/5 of Danish journeys, approximately 40 million kroner would be saved per year.

15 www.digi.no/822060/roys-vurderer-flere-videomoter-i-staten
16 Danish Agency for Governmental Management

Video conferencing in the Judicial System Network

By using video conferencing the arrested person and his or her accuser do not need to physically meet up in the court in the event of deadline extension cases. This releases resources to the police, as they no longer need to spend time escorting arrested persons to and from the majority of court proceedings concerning deadline extensions. In cases where personal appearances are required, it is estimated that the police spend approximately six hours on prisoner transport, whilst the prosecution spends approximately two. A significant side benefit is a saving in vehicle transport and therefore CO2 emissions.

Source: www.abtfonden.dk/Projekter/Telelosninger_og_IKT/Videokonferenceudstyr_i_fristforlaengelsessager.aspx (visited November 2009)

Odense University Hospital invests in tele-interpreting

In 2009 Odense University Hospital opened a regional interpretation centre where interpretation is performed via a video link through which the interpreter, patient and personnel can both see and hear each other without being in the same premises.

"Using the technology developed from telemedicine we can (...) save the time of both nurses and doctors", says director Peder Jest from OUH Odense University Hospital and Svendborg Hospital. In the slightly longer term the interpreters at the centre in Odense will interpret for patients and personnel at all hospitals in the South Denmark Region, which also plans to provide tele interpreting to GPs and municipalities.

Source: www.ouh.dk/wm281301 (visited 19 October 2009)

The committee finds that in many areas there will be significant benefits in using video conferencing solutions, which could relieve physical transport around the country. One example of this is *retsvæsenet (the Judicial System Network)*, which has already implemented test schemes using video conferencing in connection with remand prisoners and similar.

There are also great opportunities for increasing the quality of service in health care, as well as making the use of telemedicine, video conferencing and mobile technology more efficient.

There are likewise major saving potentials for the state in areas that have institutions located across the entire country – e.g. tax centres.

Virtual meetings forms generally require high broadband connections and exploiting the potential of virtual meeting forms will therefore depend on such connection being available.

Recommendations for environment, climate and green IT

- **Intelligent traffic control.** The committee sees great potential in investment in an open digital infrastructure that would support intelligent traffic control.

- **Investment in intelligent electricity systems and new modern electricity meters.** Investment should be made in a flexible and effective energy system to enable increased use of renewable energy sources. The committee recommends that an investigation be made into the need for measures that will ensure the necessary infrastructure as well as ensuring that proper digital units for exchanging digital energy information are in place. At the same time there should be investment in developing intelligent equipment for the home.

- **Videoconferences.** The public sector should take up a wider use of video conferencing. As far as possible interoperability should be ensured in public sector video solutions. The committee recommends that the state, regions and municipalities prepare specific plans for how video conference equipment may be used to ensure more efficient communication and reduce travel activity and thereby CO2 emissions.

3.6

Research and development in the field of IT

The development of a high-speed society requires continuous research into new information and communications technologies and obtaining the latest knowledge of possibilities and potential in order to implement and use these technologies in society.

Targeted investment in Danish IT research will be able to provide the raw materials for the development of the digital solutions, services and products of the future and will help to stimulate the growth of a high-speed society, for the benefit of socio-economic development.

Danish IT researchers generally achieve high-quality results, perform well on the international scene and have good penetration in international IT research publications. However, the quantity of public IT research activities could and should be significantly higher compared with the private sector.

More public IT research

In order to have more and larger projects, stronger research environments with sufficient critical mass must be established at universities. The prioritisation of IT research at universities is currently very uneven which means that in reality only a few universities that have constructed strong research environments of sufficient size to drive forward development in the field.

It is particularly important that universities prioritise the expansion of the senior researcher level, as senior researchers play a key role in the development of dynamic research environments, which can attract a strong team of competent researchers. Senior researchers are also responsible for motivating and maintaining the Ph.D. staff that wish to pursue a career in research. In this context it is also important that the university management is aware that there are interesting career paths and development opportunities with great prospects for young researchers in the field of IT.

Alongside the above, it is important that significant strategic funds are set aside for research in IT. The UMTS agreement for the period 2010-2012 has provided a much-needed increase in funds for IT research,

FIGURE 4
Expenditure on ICT R&D in 2005 and 2007

Expenditure on ICT R&D (DKK million)	**Total R&D** (combined)	**ICT R&D** (combined)	**ICT R&D** (private sector) Amount	Share	**ICT R&D** (public sector) Amount	Share
2005	37.958	9.671	8.833	91 %	838	9 %
2007	45.441	10.550	9.911	94 %	639	6 %
Forskel	**+ 7.483**	**+ 879**	**+ 1.078**	**+ 3 %**	**- 199**	**- 3 %**

Source: Danish Agency for Science, Technology and Innovation 2008 – based on figures from Statistics Denmark. A lack of data between 2005 and 2007 means that it cannot be determined whether there was a fall in the public sector's share of research expenditure between 2005 and 2007.

but it is crucial that even now there is a focus on maintaining this increase during the period after 2012, so that public sector research does not fall behind again in comparison with the private sector.

It is also important that IT achieves greater recognition as a basic research field and is not just seen as a field for applied research where the projects have specific aims. In the long term, it is impossible to imagine the IT-based innovations that will come to leave their mark on our world and it is important that IT researchers are also given room to express their creativity and to find their way with completely new ideas.

The allocation of funds for IT research must also take greater account of the fact that IT research is becoming more interdisciplinary. Many researchers are reporting that it is difficult to find relevant grant bodies as their projects often do not fall completely within the remit of one grant body, but extend across a number of fields. This applies in particular to the non-technical element of IT research.

At the same time, it is experienced that the strategic funds for IT research are spread across too many bodies. This makes it difficult to identify opportunities to apply for funds and reduces the likelihood of obtaining a grant of sufficient size to enable larger and more long-term projects to be carried out. From a research perspective, there is a need to adapt the research grant system in order to provide greater interdisciplinary access to IT research and to allocate funds of a sufficient size.

Greater take-up to IT funds from the EU's framework programmes

Central work is already in progress to increase the Danish take-up of IT funds from the EU's framework programmes. Latest figures indicate that the growth in take-up of IT funds from the EU is heading in the right direction, but there is still considerable unused potential. In the opinion of the committee, this is the result of lack of human resources in the public sector IT research environment, and of the fact that the private sector has been reluctant to participate in project applications for EU funds.

It is important that high priority is given to the advisory and supportive work relating to Denmark's participation in the EU IT programmes and that proactive efforts are made to remove the barriers to participate in the programmes – in particular for Danish companies, which are somewhat under-represented in the IT programmes compared with universities. In this context, particular consideration should be given to the development of new models of cooperation for small and medium-sized IT companies, so that they are able to manage the risks and demands on resources of taking part in EU projects. The Danish business structure makes it generally more difficult for companies to enter into consortiums for EU projects than is the case in Germany, for example, where there are many large, multinational companies with dedicated research and development departments.

The work should aim to double the Danish take-up of funds from the IT-programme in the EU's Seventh Framework Programme for research, which runs from 2011-2012 and is expected to have total funds available in excess of EUR 3 billion.

Stronger public-private cooperation on IT research and development

Public-private cooperation on IT takes place not only under the auspices of the EU's framework programmes, but also in many different formal and informal contexts where the parties consider that working together on specific research and development projects may be mutually beneficial. Unfortunately, there are still many barriers to opening up this kind of cooperation.

It is the opinion of the committee that research work between public sector research institutions and private companies should act as the natural pivotal point for IT development. This is an important factor for ensuring dynamic and innovative development in this area and it is vital if the results of the research are to quickly find their way to the general public, companies and authorities and to add value in society.

In Denmark there are already "clusters" of companies, universities, knowledge institutions and public authorities, which are successfully collaborating on research and development within a specific area, such as financial services and green technologies. What they have in common is that their cooperation is formalised around "cluster organisations", which handle coordination within the cluster and develop the cooperative interfaces that exist between the members.

The European Cluster Observatory, which is an independent institution financed by the European Commission, has documented that companies which are part of a cluster

- Are more innovative,
- Have higher growth rates,
- Have greater exports,
- Attract talented labour and
- Pay higher salaries

It is the opinion of the committee that cooperation in clusters with a central coordinating cluster organisation can be a significant asset in relation to increasing public-private cooperation in the field of IT. The committee sees clear potential in supporting the establishment of one or more clusters within the following areas, for instance:

- Intelligent energy control
- Intelligent traffic control
- IT, digital media, gaming and educational materials.
- Health IT

At the same time, there is great potential in involving public and private research institutions in the field of IT in existing clusters, where relevant cooperative interfaces can be identified.

In order to support the research in the above areas across public institutions and private companies, support should also be given to the creation of one or more "Centres of Excellence". Centres of Excellence are centres or networks consisting of one or more groups of researchers, which together form a leading research unit at the highest international level within a given area. The aims are to carry out dynamic and leading specialist research, to stimulate the development of research training environments, to generate significant international attention and penetration of the research and not least to ensure that the results of the research help to develop society. Centres of Excellence can be members of a cluster or act as an independent unit.

Rollout, development and integration of the IT resources of universities

New research methods, which make use of advanced IT resources, have the potential to strengthen the scientific process and to create new groundbreaking results in many different areas of research.

The Danish Research Network is an existing IT infrastructure for cooperation between Danish universities and research institutions, which among other things provides high-speed broadband connections of up to 10 Gbit/s to the participating institutions. Combined with the Danish Centre for Scientific Computing (which provides high-performance computing) and Denmark's Electronic Research Library (which provides research-based information resources), for example, Danish universities have the IT resources to establish a strong "research cloud" (cf. the earlier description of "cloud computing"), which will be able to act as a test environment and collaborative platform for IT-related research and development activities. This means *both* IT research and IT-*based* research (e-Science).

Furthermore, Danish companies with relevant IT research and development activities could obtain access to the research cloud as it can also act as a platform for increased public-private cooperation. There is further potential in that a research cloud could be a catalyst for the development of new clusters in the field of IT.

Examples of Danish clusters and cluster organisations

Copenhagen Finance IT Region:
Development of IT-supported financial services.
www.cfir.dk

Copenhagen Cleantech Cluster:
Development of green technologies.
www.copenhagencleantechcluster.dk

Medicon Valley:
Development within biotech, pharmacology and medicine.
www.mediconvalley.com

Recommendations for research and development in the field of IT

- **Increased Danish research in IT.** Efforts should be made to create more posts for senior researchers and PhD students within IT at universities. In addition, stronger research environments and more interesting career paths should be created.

- **More strategic funding for research in IT.** The research granting system should have greater awareness of the interdisciplinary nature of IT research and funds should be allocated from fewer pools with greater volume and a broader perspective.

- **Increased take-up of IT funds from EU's framework programmes.** Efforts should be made to increase advisory initiatives targeted small and medium sized IT companies. In addition, new public-private cooperation models for companies and research institutions should be developed.

- **Clusters.** With the aim of increasing penetration and take-up of IT research nationally and internationally, efforts should be made to establish one or more clusters and Centres of Excellence within Danish positions of strengths such as intelligent energy and traffic control, digital media, gaming and educational materials as well as health IT.

- **Development and integration of universities' high-speed infrastructures and electronic resources.** There are good opportunities to integrate the IT resources of the Danish Research Network, the Danish Centre for Scientific Computing and Denmark's Electronic Research Library, for example, in order to establish a "cloud" for IT research and e-Science in Denmark. These opportunities should be exploited.

3.7

Broadband infrastructure in Denmark

Denmark must have a broadband infrastructure that is among the best in the world in terms of quality, speed and mobility.

It is therefore important to ensure that there are good framework conditions in Denmark for investment and to operate business in the field of broadband. At the same time, it is important that there is a high degree of transparency on the broadband market and that the public sector focuses on promoting the use of broadband. Investments in infrastructure require regulatory assurance and predictability as well as clear political visions and signposts to indicate the political priorities in the field.

The European Commission's definition of a broadband connection is a minimum of 144 Kbit/s (downstream). The OECD definition is a minimum of 256/s (downstream). Where broadband is referred to below, it is based more on actual speeds and usage rather than the applicable minimum definitions.

Broadband facts: Availability

- More than 99 per cent of all Danish households and businesses have access to broadband with a downstream capacity of at least 512/s.
- 98 per cent have access to a downstream capacity of at least 2 Mbit/s.
- 77 per cent have access to a downstream capacity of at least 10 Mbit/s.

- Mobile broadband has geographical coverage of around 97 per cent.

Source: Danish National IT and Telecom Agency telecom statistics and Broadband mapping 2009.

17 European Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks, European Commission, 2009.

There is no actual definition of "high-speed network". The European Commission has a definition of a so-called Next-Generation Access network (NGA network) in its guidelines for State support to establish broadband networks.[17] An NGA network is defined in practice as a fibre network and advanced cable network. The European Commission believes that mobile technologies are not currently in a position to deliver high-speed broadband services, but notes that the situation may change in the future, particularly once "Long Term Evolution" (LTE) is introduced on the market.

Broadband facts: Penetration

In Denmark there are 37.1 fixed broadband connections for every 100 inhabitants.

- 91 per cent have a downstream capacity of at least 2 Mbit/s.
- 27 per cent have a downstream capacity of at least 10 Mbit/s.
- 1 per cent has a downstream capacity of at least 50 Mbit/s.

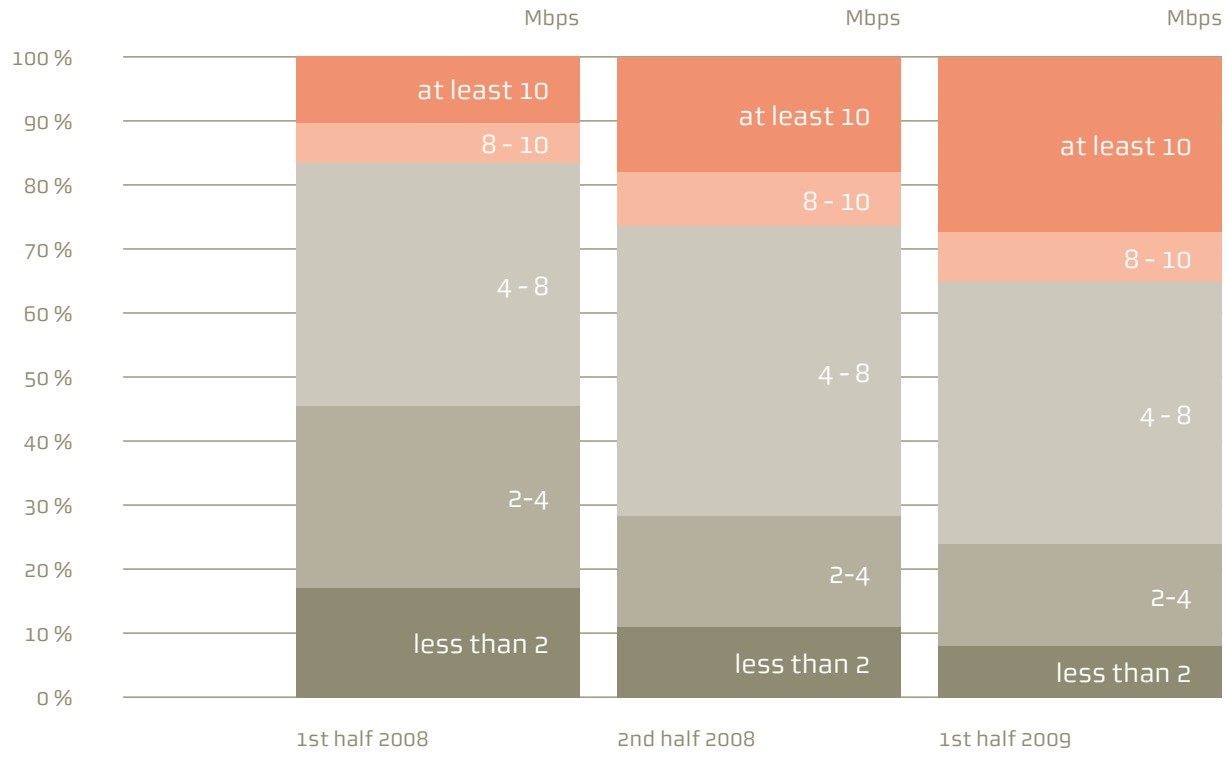
- 24 per cent have an upstream capacity of at least 0.5 Mbit/s.
- 35 per cent have an upstream capacity of at least 1 Mbit/s.
- 5 per cent have an upstream capacity of at least 10 Mbit/s.

In Denmark there are 7.6 mobile broadband subscribers for every 100 inhabitants.

The growth in the market is particularly evident in high speeds and mobile broadband. The availability of broadband via fibre networks is also increasing. As a result, 28 per cent of all households and businesses had access to fibre optic broadband by the middle of 2009. The figure for the previous year was 18 per cent.

Source: Danish National IT and Telecom Agency telecom statistics and Broadband mapping 2009.

FIGURE 5
Downstream capacity trend, 2008-2009



Source: National IT and Telecom Agency

Status of broadband in Denmark

The level of access to broadband in Denmark is currently one of the best in the world. Denmark is also one of the world leaders when it comes to the penetration and usage of broadband. This is particularly true in terms of the penetration of fixed network broadband. In terms of the penetration and usage of mobile broadband, Denmark is behind the leading countries.

The broadband speeds available in Denmark are not among the fastest in the world and prices for broadband have been higher in Denmark than in many other countries. Broadband speeds are rapidly increasing, however, the prices for broadband have fallen in recent years and can therefore not be considered a barrier to the development and usage of broadband in Denmark.

It can therefore be determined that most of the familiar current possible uses within the public sector, in business and among consumers can largely be satisfied by the current broadband services available on the market.

Broadband speeds are increasing. The proportion of fixed network subscribers with a marketed downstream capacity of at least 10 Mbit/s has almost trebled from 10 per cent in the first half of 2008 to 27 per cent in the first half of 2009. The figures show that it is actually only speeds of at least 10 Mbit/s that are increasing (the figures do not include mobile broadband).

Future demand for broadband in Denmark

The committee believes that the demand for broadband for many users will in the future far exceed the level of usage today. Furthermore, there will be increasing demand for coverage and capacity in the mobile networks.

There is therefore still a need for significant investment in infrastructure in order to be able to meet future demand.

The broadband infrastructure in Denmark should, in the opinion of the committee, be fully able to support the advanced use of IT by the general public and support streamlining, growth and innovation in both the private and public sectors.

In the report "Vurdering af fremtidens behov for bredbånd" [Analysis of the future demand for broadband] (2009) Gartner examines how the demand for broadband will develop by 2013 and 2020. This is shown in the diagram in figure 6.

Examining more closely what the demand for broadband will be in 2013, it is the opinion of the committee that the broadband infrastructure should specifically be able to support the public's use of, for example, working from home, e-learning, videoconferencing, streaming video and news, entertainment, public digital services and the digital exchange of images, video clips and documents. These are all services that can be realised in a household with a transfer speed of 5-10 Mbit/s downstream and up to 5 Mbit/s upstream.[18]

The demand for broadband in a household largely depends on whether high quality live images (e.g. HDTV) are to be delivered via the broadband connection. Demand is also dependent on whether there is a requirement to use different services simultaneously in a household and whether, for example, there is a desire to watch more than one TV channel at the same time. In addition, the use of high-quality videoconferencing equipment, cloud-based services or home security solutions using video surveillance equipment, for example, may result in demand for higher speeds, including higher upstream speeds.

Any analysis of the demand for broadband in 2013 should also take into account the fact that there will be new and innovative services requiring broadband on the market, which we are not currently aware of and which will be demanded and used by consumers.

Against this background, it is the committee's assessment that it will be possible to meet the demand for broadband in 2013 for a large proportion of consumers who do not use a broadband connection for HDTV by offering speeds of 10 Mbit/s downstream and 5 Mbit/s upstream.

It is also the committee's evaluation that it will be possible to meet the demand for broadband in a household where there are several users with a more advanced use of IT, and where the connection is used for TV, in 2013 by offering speeds of 50 Mbit/s downstream and 10 Mbit/s upstream.

This will provide the individual household with sufficient capacity to simultaneously run different services requiring broadband with a satisfactory level of quality. At the same time, such capacity will form the basis for innovation and it will also facilitate and stimulate the development of new, advanced services, where the users themselves are involved in creating, sharing and developing content.

In the longer term, the committee believes that the demands for broadband will increase significantly as services and possible uses develop. There is no sense in trying to predict what services, what content and what possible usage will be in greatest demand in 2020.

The committee believes that the desired bandwidth will increase manifold and in 2020 will be up in the vicinity of 1 Gbit/s for the most demanding users. Of the technologies of which we are currently aware, clearly only fibre optics will be able to deliver connections with such speeds.

A rapid development in technology is underway, however, and it is considered that from a future perspective, mobile broadband (LTE Advanced), for example, will be able to provide much higher speeds. Commercial services based on LTE technology have already been launched in Norway and Sweden in 2009, allowing speeds of 50 Mbit/s.[19] The expansion of the mobile broadband network will probably require a well-constructed underlying fibre infrastructure to provide transmitters with high transfer speeds.

The committee considers that the high-speed society of the future will need both mobile and fixed broadband technologies. The committee is unable to indicate specific technologies that should be subject to greater investment than others in the future. This is partly because of the

18 More detailed speed requirements for individual services are specified in part II of the report.

19 www.telia4g.se/om-4g

rapid development of technology and partly because the market, providers and consumers are the ones who will determine which technologies are required and which services are able to meet demand and at what price.

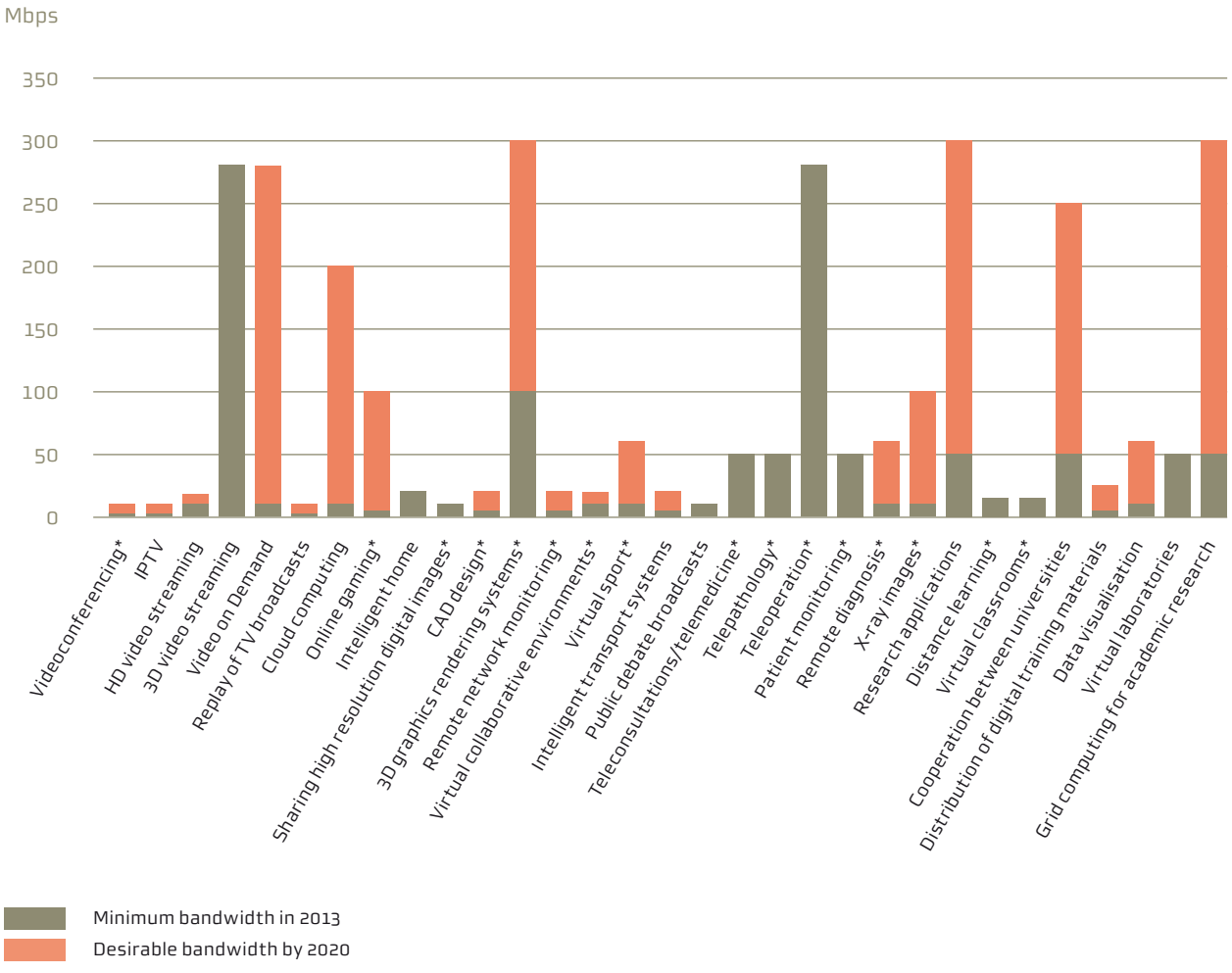
A market-driven, technology-neutral development

The development of broadband infrastructure in Denmark should, in the opinion of the committee, continue to be based on a market-driven, technology-neutral development and there should initially be the least possible public regulation of the market. The role of the public sector must be:

- To ensure stable, modern and predictable regulatory frameworks that enable real competition on the market
- To demand and use broadband infrastructure and services

The market should – as before – largely ensure that the infrastructure is expanded in order to meet the growing demand for bandwidth. The market will not, however,

FIGURE 6
Bandwidth range for services



Source: Gartner, Vurdering af fremtidens behov for bredbånd [Analysis of the future demand for broadband], prepared for the High Speed Commitee (2009).

**) demands symmetric up-/download*

be able to ensure an expansion that will enable all households and companies to have access to increased speeds at the same time and of the same quality. There will therefore be different levels of investment in infrastructure in areas of Denmark.

Against the background of, among other things, the European Commission's guidelines for state support for broadband infrastructure, the committee has discussed whether public funds should be invested in infrastructure in Denmark in order to ensure, among other things, that high-speed broadband is established for all, including in sparsely populated areas and on small islands.

The committee considers initially that the direct investment of public funds in infrastructure should be avoided, as this will have a damaging effect on competition on the market and will negatively affect incentives for the players on the market to make the necessary investment under commercial conditions. The risk is that public investment will force out private investment and that the market dynamic, which balances demand, supply and finance and has made Denmark one of the leading countries in the world, will be shattered.

In order to enable municipalities, in specific and special circumstances, to take steps to promote the development of broadband and ensure access to broadband for residents and companies, however, the committee recommends that the opportunity is provided for an exemption to be granted – on small islands for example – so that a municipality is permitted to support the establishing of broadband infrastructure. It must be noted that this can only take place in special circumstances and must be done under technology-neutral conditions. Infrastructure established with public sector support must be open to third parties and it must be ensured that the municipalities themselves in no way provide telecoms networks or services.

At the same time, the committee wishes to stress that in those municipalities where there is less availability of broadband, a number of initiatives can be used to help stimulate the use of broadband and so create incentives for investment.

Stimulation of demand

Public sector demand and public sector initiatives can help to ensure the development of the broadband infrastructure in Denmark. This applies to public sector usage of broadband in the provision of public services and also to the establishing of broadband connections between public institutions.

By demanding and using broadband solutions, the municipalities can contribute to stimulate the development of broadband infrastructure in the given region. If, for example, a municipality establishes broadband for all schools, nurseries, care homes and other relevant institutions, it will make a significant contribution to generally stimulating the establishment of a broadband infrastructure in the municipality under market conditions, which will also benefit residents and businesses.

The municipalities can thereby use initiatives to stimulate the expansion of the infrastructure in more sparsely populated areas and form part of more general investment for regional and commercial development.

It is important to stress that the public sector demand must be driven be real need and must stimulate the market in a way that does not distort competition.

In order for the municipalities to be able to stimulate the development of broadband, guidelines must be drawn up and advice provided to the municipalities on their specific options and showcases should be established in order to inspire the municipalities and promote development with the common use of the investments made.

Initiatives should also be implemented in this context to provide municipalities with incentives and opportunities for faster case handling with regard to applications to erect masts and antennas. In this context, better dialogue should be achieved between telecom companies and municipalities with regard to promoting understanding of the different considerations and interests.

Some telecom companies also find that when permission to erect masts and antennas is granted, it can be difficult to obtain reasonable lease agreements with the site owners (including municipal site owners).

Further investigation is required in this context to ascertain whether initiatives can be implemented to help encourage discussion and agreement between site owners and telecom companies, possibly in the form of mediation.

Furthermore, initiatives should be implemented to

increase the opportunities and incentives for the municipalities to ensure better coordination of excavation activities in the municipality and the laying of empty pipes in relation to promoting overall infrastructure development. Action to ensure that empty pipes are established and that space is provided for modern communications infrastructure in new constructions and building maturation should be taken.

The laying of the broadband infrastructure is made more difficult in some parts of Denmark by the fact that the municipalities do not have the same access rights to private communal roads in rural areas as they do in urban areas.
It should therefore be investigated whether there is a basis for extending the access rights of municipalities to include private roads in rural areas in order to encourage faster access to the establishment of high-speed networks in rural areas.
Finally, steps can be taken in the municipalities to encourage competition between different types of infrastructure by removing the commitments currently in place to contribute to antenna associations. Steps should be taken to remove the obligation to join antenna associations so as to ensure competition and to enable users to have a free choice of broadband provider.

Broadband for all

The United Kingdom, Finland and France have decided to ensure that everyone has access to broadband by stipulating an universal service obligation to provide speeds of between 512 Kbit/s and 2 Mbit/s. The committee assess that Denmark needs to introduce such a provision obligation at the present time, partly because of the very wide availability of broadband in Denmark – via both fixed and mobile networks.

The committee does believe, however, that initiatives should be implemented to ensure the expansion of the mobile broadband network across all of Denmark. There are currently still some areas of Denmark where it is not possible to obtain high-speed data access via mobile phone.

The committee recommends that the frequencies in the 800 MHz band, which form part of the "digital dividend", be used for mobile broadband. It is expected that the frequencies will be ready to be taken into use in 2013, following an auction or public tender.

These frequencies are particularly suitable for ensuring geographic coverage of mobile broadband. It is the opinion of the committee that an initiative to ensure better broadband coverage will be able to stimulate the use of, for example, mobile technology in old people's homes and homecare in the municipalities.

In this respect, the committee recommends that opportunities are created to share networks between providers so as to ensure optimum utilisation of the capacity of mobile networks.

Furthermore, the committee finds that the high prices of international data roaming represent a barrier to the use of broadband services for both private consumers and businesses. The committee therefore recommends that Denmark push for further initiatives to be taken at EU level to secure lower prices for international data roaming.

IT and broadband as attractive investment areas

The committee finds that huge efforts must be made in Denmark to ensure the penetration and use of high-speed broadband within both the private and the public sector. In order to encourage this development and support the government's aim of Denmark developing into a true high-speed society, it is important that the government and the municipalities in future see IT and broadband, as an area in which there should be active investment.

Against this background, the committee considers that, as previously suggested, the revenue that the government receives from holding an auction in this area should be earmarked and fed back into the sector to finance development activities designed to stimulate the growth of the high-speed society.

An expanded broadband infrastructure in Denmark will help to attract high-tech companies and investments in new digital services. Thus Denmark will again be an attractive testing and pioneering country for digital services in the same way, as was previously the case in the mobile sector.

Depreciation rules and taxation matters are extremely important for how attractive it is to invest in high-speed infrastructure. In the other Nordic countries, annual depreciation for investments in infrastructure is significantly higher than it is in Denmark. This makes it more

attractive from a tax perspective to invest in high-speed networks in these countries.

Against this background, the committee finds that there should be further investigation into whether the depreciation rules correspond to the actual lifetime of investments in infrastructure in order to assess whether there are grounds to change the depreciation rules in Denmark.

Furthermore, the committee finds that initiatives should be implemented to enable longer binding periods in the telecoms sector, for example up to 12 months. Longer binding periods may prompt more risk-inclined investment in new technology.

Transparency on the market

The committee finds that there is a need to ensure greater transparency on the broadband market, as it can be difficult for consumers to find their way among the many different products. The committee therefore recommends that an information label is introduced for broadband services, so that consumers are given clear and comparable information about relating issues as prices, subscription terms and conditions and a guaranteed minimum speed.

The information label for broadband services must, as with price details, is included in relevant contexts, which describe the services in question.

Adjustment of telecoms policy

The current telecom policy dates back to 1999. The time is therefore ripe to set in motion a process to draw up new telecom policy aims. Any process to formulate a new policy should be based on the aims and principles described in this report.

Furthermore, the telecom policy should take a more commercial policy view and focus on how competition on the market can be ensured in the future in order to benefit consumers.

A key element of the telecom policy has been to ensure a balance between service-based and infrastructure-based competition. With the current consolidation on the market, recently illustrated by the acquisition of DONG's fibre network by TDC, there is a risk that one player may again predominantly own the fixed network infrastructure. TDC has announced, however, that it intends to open up the network to service providers.

If one or only a few players own the infrastructure, infrastructure-based competition for the fixed network becomes severely limited. This increases the need to ensure, through regulation, that service providers have access on equal and non-discriminatory terms to provide services on the fibre network, for example.

The same challenge applies in the event that other fibre networks are kept closed to external service providers. There is currently uncertainty about whether the energy companies' fibre network will be closed to external service providers. In the same way, this increases the need to ensure through regulation that it is possible to guarantee properly functioning service-based competition on the fibre network, where there is no real alternative access route to consumers.

It is still important to ensure both infrastructure-based and service-based competition. A new telecoms policy, however, should have increased focus on how, from a future perspective – to the extent that there are no real alternatives – the optimum conditions can be ensured for service-based competition.

Furthermore, the committee finds reason to stress that the telecoms policy should place particular focus on how the regulation of the market and frequency administration can be used in the future to advance the following key aims:

- New technologies are able to go to market quickly.
- Equal treatment and equal competitive opportunities on the market.
- Stable regulatory frameworks and reliability of regulation, which may promote long-term investment.

Furthermore, the new telecoms policy should place increased focus on how IT and broadband can create value for society. In this context, specific initiatives should be implemented to ensure that in the future coherent statistics and documentation are drawn up for IT businesses in Denmark, which among other things document the size and development of the IT sector and to a large extent help to illustrate the value created by IT. This should be done in close consultation with the players in the industry.

Recommendations for Broadband infrastructure in Denmark

- **Market-based development.** It is the opinion of the committee that the development of the market should continue to be grounded in market-based, technology-neutral access.

- **New goals should be established for the field of broadband .** It is the opinion of the committee that at least 80 per cent of all Danish households and businesses should have access to speeds of 50 Mbit/s downstream and 10 Mbit/s upstream in 2013. Furthermore, all – or almost all – Danish households and businesses should have access to broadband with a speed of 10 Mbit/s downstream and 5 Mbit/s upstream in 2013. In the opinion of the committee, this can be achieved through a market-based development, combined with investment by the public sector in the use of IT and broadband in all parts of the country. Increased public usage will provide greater incentives on the market to make investments in infrastructure.

  * A minority of the committee, consisting of Jesper Hjulmand, Birger Hauge and Ole Ivanoff, is unable to support this goal drawn up by the committee for access to high-speed broadband, as the goal does not cover everyone in society. The statement of this minority is given in full in the appendices. The statement of the minority has given rise to comments from a majority of the committee members. These comments are also provided in the appendices.

- **Mobile broadband.** Frequencies in the 800 MHz band (790-862 MHz) should be used for mobile broadband. There should be greater opportunities for network sharing between providers, so as to enable optimum use of the mobile network. Finally, further initiatives should be taken at EU level to ensure lower prices for international data roaming.

- **Frameworks of the municipalities.** Clarification should be provided of the frameworks for how the municipalities and regions can prepare and implement initiatives to help develop broadband infrastructure locally and especially in sparsely populated areas. Clear guidelines should be drawn up here for the options available to municipalities and regions to establish broadband in order to support public services, establish broadband in public institutions, coordinate excavation work and establish empty pipe infrastructure. Furthermore, opportunities should be provided for municipalities, in specific and special circumstances – such as on small islands – to be able to support the establishing of broadband infrastructure.

- **Easier erection of mobile masts and antennas.** The case handling of the municipalities with regard to applications to erect masts and antennas must be improved. Recommended case handling times for different types of case must be clearly defined and specific case handling times must be published. In return, the players in the industry should make the municipalities' task easier through better coordination and higher quality applications. Furthermore, better dialogue should be achieved between telecoms companies and municipalities with regard to promoting understanding of the different considerations and interests. Finally, further investigation is required here to ascertain whether initiatives can be taken to help encourage discussion and agreement between site owners and telecoms companies, possibly in the form of mediation.

- **Easier excavation access in rural areas.** It should be investigated whether there is a basis for extending the access rights of municipalities to include private roads in rural areas in order to encourage faster access to the establishment of high-speed networks in rural areas.

- **Removal of joining obligation.** The obligation to join antenna associations should be removed so as to ensure competition and to enable users to have a free choice of broadband provider.

- **The proceeds from auctions should be fed back to the sector.** The government revenue from holding auctions in this area should be fed back into the sector to finance activities designed to stimulate the development of the high-speed society.

- **Depreciation rules for investments in high-speed networks.** It should be investigated whether there are grounds to change the depreciation rules for investments in infrastructure and to ensure that the tax rules correspond to the actual lifetime of the infrastructure and equipment.

- **Binding periods.** Initiatives should be implemented to also enable longer binding periods for consumers in the telecoms sector, for example up to 12 months.

- **Increased transparency on the broadband market.** An information label scheme should be established – as is the case for price information – for broadband services, describing the services in question, including actual speeds.

- **New telecoms policy aims/targets.** It is time to formulate new telecoms policy aims that take a more commercial policy view and focus on how IT and broadband create value for society. The telecoms policy should place additional focus on ensuring good opportunities for service-based competition in the future. New telecoms policy aims should be drawn up in close cooperation with the players in the industry.

- **New IT statistics.** Initiatives should be implemented to draw up new, coherent statistics on IT businesses and the social importance of IT and broadband.