Microsoft

PUBLIC SECTOR MODERNIZATION

BENEFITS AND BARRIERS TO ADOPTION OF NEW TECHNOLOGY| 31 AUGUST 2012

INFORMED DECISIONS

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PREFACE

Microsoft Denmark has asked Copenhagen Economics to review the benefits to be had for the public sector in EU from adopting cloud computing and unified communications technology. The study should survey the findings in the literature regarding the benefits for the public sector from using the technologies. The study should focus on the following countries: Belgium, Netherlands, Luxembourg, Spain, Italy, Portugal, Denmark, Norway, Sweden, and Finland. The study should also focus on the benefits and barriers associated with cloud and unified communications in public administration, health care and education. Furthermore, the study should present the barriers that exist for the take-up of the technologies in the public sector, and possible policy decisions necessary to remove the barriers. The findings should be presented in a report delivered to Microsoft end May 2012.

This report has benefitted from the input of Anders Thomsen and Anders Johansson, Microsoft, and Lennart Håkansson, Cohn&Wolfe, and Martin H. Thelle, Copenhagen Economics. Any errors, misunderstandings or omissions are the responsibility of the author.

Chapter 1 | EXECUTIVE SUMMARY

Key findings:

- 6.2 billion Euro can be saved in 10 countries from utilizing cloud computing and unified communications
- Economic and regulatory barriers need to be reduced to release this potential
- Broadband infrastructure and ICT readiness needs to be in place

Public budgets will come under pressure in the EU in the years to come, and governments need to look for ways to maintain or improve service levels while at the same time cutting cost. New technology can contribute to this. Cloud computing and unified communications technology offer lower costs, higher productivity and better performance for public institutions. Cloud computing can save costs of investment, maintenance and operations, because public institutions are centralized with specialized ICT service providers, who generate advantages of scale. It offers more stable performance, better possibilities for sharing information and resources for public employees, and it provides a platform for developing new services at a larger scale. Unified communications allow public sector employees to meet virtually, saving travel costs, increasing frequency and quality of their interactions, and saving working time and costs of sending information.

In this study we have focused on how these technologies save costs for the public sector. Naturally there are several other important benefits. For example, lower impact on the environment in terms of less carbon emissions due to reduced electricity consumption and less carbon emissions related to travel. There are also several benefits for citizens, who will experience easier communications with the public sector, less time spent communicating with public sector, better services and more stable services. This means that the cost saving gains we have quantified only are a part of the total gains from the public sector using the technologies.

We estimate that cloud computing and unified communications together can save more than Euro 6 billion per year for the public administration, health care and education systems in the Nordic countries, Benelux and Spain, Portugal and Italy. This is an important contribution, especially taking into account that we are only estimating cost savings from reduced travel, more hours of effective work, reduce communication costs, and cost savings for the ICT departments.

In order for public sectors in EU to take up cloud computing and unified communications on a larger scale, it is important to reduce economic and regulatory barriers to public sector take-up of these solutions. The economic barriers are serious and have to do with the individual public institution not having incentives to save money, because doing so will reduce their budget. We estimated that in Spain, only a tenth of the savings which an educational institution realizes actually accrue to the institution itself. The rest goes to other parts of the

public sector. The regulatory barriers mainly affect cloud computing. They are related to data security and privacy regulation. These barriers are important, but new EU regulation offers a chance to reduce the barriers.

One solution to the economic barrier is a structural reform of public funding. Such a reform is an enormous task and should not be undertaken with the sole view of allowing for cloud and unified communication, but because it will improve the general performance of the public sector. Another approach to removing the economic barrier is a more centralized decision making about public sector purchases of ICT. The advantage is that more central decision makers will not be as prone to sub-optimization as the de-central decision makers are. A disadvantage is that central decision makers will be less aware of the local needs and may therefore make decisions that are not the best solution to the local needs. A third approach is to set aside targeted funds for investments in technology. That will improve local incentives to save money, but may still generate local opposition, because new technology may still appear to the local public institutions as precursors of budget cuts.

A final set of conditions which are important for the ability to take up unified communications and cloud computing are the presence of necessary broadband infrastructure and ICT-readiness. We are not aware of any comprehensive studies which have estimated the required broadband infrastructure and ICT readiness in order to service different levels of use of cloud computing and unified communications. The public sector should consider whether the current broadband capacity and ICT readiness is sufficient to allow for the full potential benefits to be reaped from new technology.

Chapter 2 CHALLENGES FOR THE PUBLIC SECTORS IN THE EU

Key findings:

- Public finances in 10 Western European countries under pressure.
- Transport, communication and ICT make up 5 to 20% of public purchases
- Public sector costs of transport are large in Nordic countries
- Public post and telecommunications costs are large in Spain
- Public costs of computer and related services are large in Denmark, Sweden, Finland, Belgium and Luxembourg

In this chapter we describe why the public sectors in EU need to look for ways to reduce expenditure in the future. First we describe the challenges relating to financing the public expenditure, then we describe the development in public expenditure. Finally we point to some important expenditure drivers.

European public sectors are becoming increasingly costly for the societies. Public expenditures are increasing, public debts are increasing, and it is becoming more and more difficult to finance the public expenditures. Currently these developments are driven mainly by the international financial crisis, which drive up costs of unemployment insurance and interest rates on public debt, at the same time as tax revenues are decreasing. The problems are not likely to disappear in the longer run. In the longer run, the ageing populations in the EU will lead to increasing costs of pensions and decreasing tax revenues. Furthermore, technological progress in the health sector and continuing increases in the incomes of the working population will fuel demands for more and better public service. Hence, public sector expenditures will keep increasing for an extended period of time. At the same time, globalization will make capital and labour more internationally mobile, making them more difficult to tax. Thus, the combined problems of increasing expenditures and a shrinking tax base will persist for a long time.

We have summarized the longer-term challenges on the funding side for the public sectors in the countries we consider in Table 2.1. The table shows in the horizontal dimension how difficult it is for the public sector to get funding by the use of income taxes, in the vertical dimension it shows how difficult it is to raise funding by issuing debt.

Table 2.1 Longer term fiscal challenges for a selection of EU countries

		Cost of public funds	
		Low	High
Debt levels	Low	Spain, Luxembourg, Netherlands	Denmark, Finland, Sweden
	High	Portugal	Belgium, Italy

Note: On the vertical dimension a country is classified as high (low) if the debt to GDP level is above (below) EU27 average in 2011. On the horizontal dimension a country is classified as high (low) if the estimated marginal cost of public funds is above (below) the median estimate for the 5th decile in the intensive-extensive model in Kleven and Kreiner (2006). Norway is not included in Kleven and Kreiner (2006) and is therefore not included in the table.

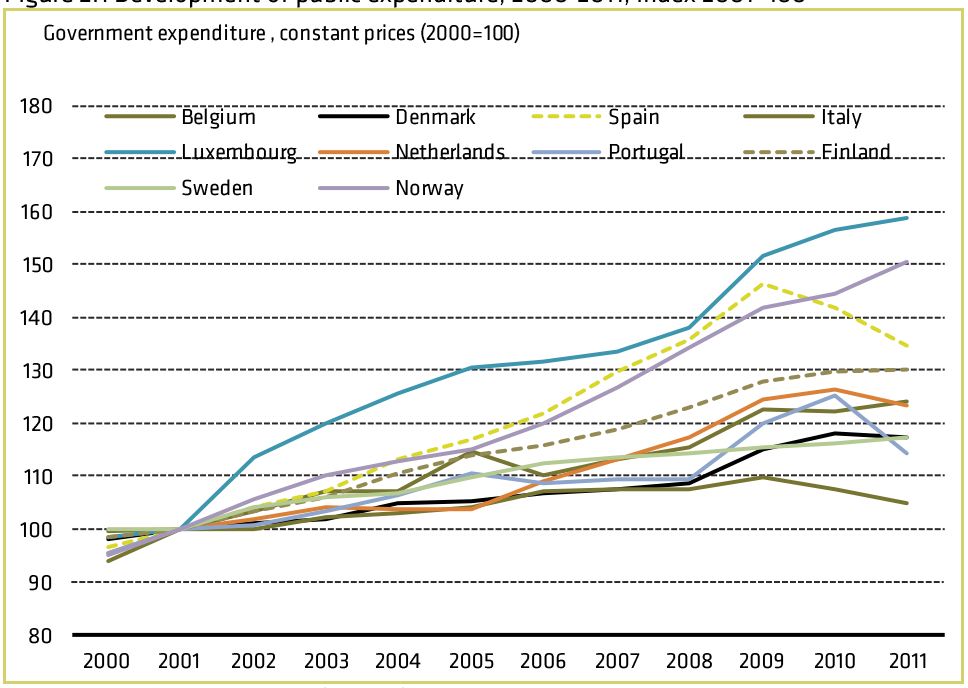
Source: Kleven and Kreiner (2006): "The Marginal Costs of Public Funds: Hours of work versus Labor Force Participation", table III. Eurostat, gov_dd_edpt1.

The difficulty of getting funding is measured by the so-called marginal cost of public funds, which summarizes how much it costs to fund an extra Euro of public expenditure. The costs encompass the value of the resources spent as well as the reduction in labour supply which arises because income taxation makes it less economically attractive to work. These costs have been estimated by Kleven and Kreiner (2006). The debt level is measured by the debt to GDP-ratio. So for example Italy will have difficulty financing higher public expenditure by collecting more taxes, and it will also have difficulty issuing more debt. On the other hand, a country like Netherlands will be able to fund greater public expenditures in the future by using both taxes and issuing debt.

The placing of Spain in the category with low cost of public funds and low debt levels may appear surprising in the light of the current situation in financial markets. However, Spanish debt as a share of GDP is just below average. It may be increasing rapidly, but the latest Eurostat data places the country in the category shown above.

An impression of the challenges on the expenditure side can be had from Figure 2.1, which shows the development in government expenditure from 2000 to 2011 for the countries we consider. The figure shows increasing expenditures for all the countries we consider. An extreme example of expenditure growth from the figure is Portugal, where government expenditure has increased more than 10 per cent per year since 2000.

Figure 2.1 Development of public expenditure, 2000-2011, index 2001=100

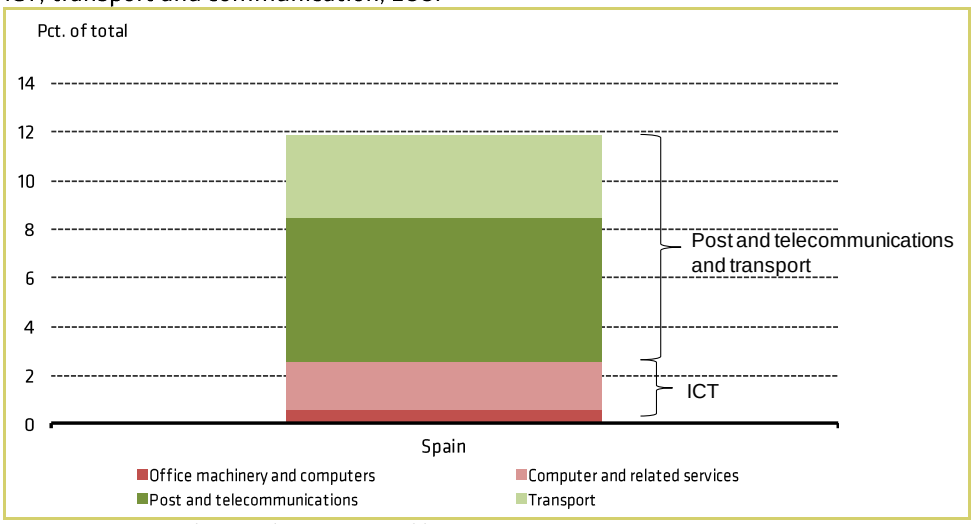


Source: Eurostat (gov_a_main & prc_hicp_aind).

The increase in public expenditure is not only driven by an increase in the number of employees. The expenditure per employee has also increased.

A large share of the public expenditure comes from purchases of goods and services from other sectors. In the 10 countries we are analyzing, a large share of the purchases are related to office machinery, computers and services related to them (ICT), transport and communication. The sum of the costs of ICT, transport and communication makes up between 5 and 20 per cent of total public sector purchases in public administration, health and education.

Figure 2.2 Expenditure in public administration, health care and education related to ICT, transport and communication, 2007

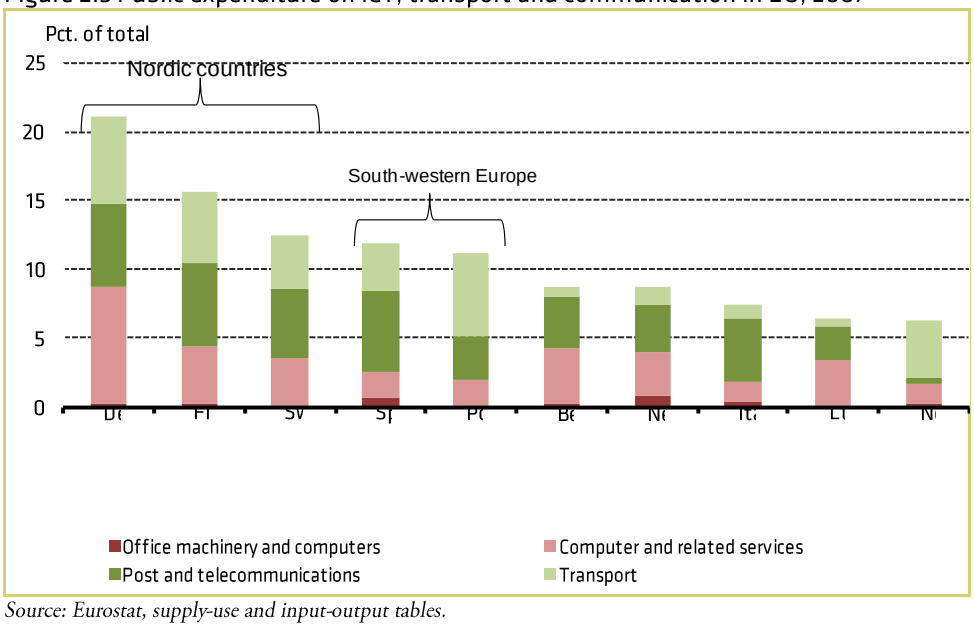


Source: Eurostat, supply-use and input-output tables.

In Figure 2.2 an example is shown of the expenditure in public administration, health and education on ICT, transport and communications in Spain. From the figure it can be seen that ICT constituted approx. 2.5 per cent (Euro 1.6 billion) of Spanish public purchases in 2007, while post and telecommunications makes up approx. 9.5 per cent.

Spain has neither extremely high nor extremely low public expenditure on these kinds of purchases. In Figure 2.3 it can be seen that the Nordic countries tend to spend a large share of their purchases on ICT, transport and communication, while the Benelux-countries tend to spend a smaller share of purchases on these goods and services. One reason for this is the higher population density in the Benelux-countries. This is the reason why transport tends to be a major expenditure item in the Nordics. In some of the countries the cost items we are considering make up a very large share of purchases. In Denmark, the four expenditure items made up more than 20 per cent of purchases in public administration, health care and education (approx. Euro 2 billion).

Figure 2.3 Public expenditure on ICT, transport and communication in EU, 2007



Source: Eurostat, supply-use and input-output tables.

Thus, for the countries we are analysing in this report, public expenditure is increasing. Most of the countries will face structural problems with financing the increasing expenditures in the future. An important part of the public expenditures come from ICT, transport and communication.

Chapter 3 BENEFITS FROM PUBLIC SECTOR MODERNIZATION

Key findings:

- We estimate that in the ten countries analyzed, potential public savings from cloud computing lie in the neighborhood of 3.3 billion Euro per year
- We estimate that in the ten countries analyzed, potential public savings from unified communications lie in the neighborhood of 3 billion Euro per year

In this chapter we consider two technologies that help bring down public expenditure on ICT, transport and communication.

Cloud computing is a collective term for pay-per-use IT services that are delivered over the internet. A cloud computing provider sells a service to a procurer, who can access the service through a web browser without installing or maintaining software on his own systems.

Cloud computing covers three service models:

- Software as a service (SaaS): Using an application without controlling the operating system, hardware or network infrastructure on which the application is running.
- Platform as a service (PaaS): Using a hosting environment for applications without controlling the operating system, hardware or network infrastructure on which the application is running.
- Infrastructure as a service (IaaS): Using computing resources on a virtual machine, such as processing power, storage and network without controlling the cloud infrastructure

Unified communications (UC) is the integration of real-time communication services such as instant messaging (chat), presence information, telephony (including IP telephony), video conferencing, data sharing (including web connected electronic whiteboards aka IWB's or Interactive White Boards), call control and speech recognition with non-real-time communication services such as unified messaging (integrated voicemail, e-mail, SMS and fax). Figure 3.1 illustrates this.

Figure 3.1 Illustration of unified communications

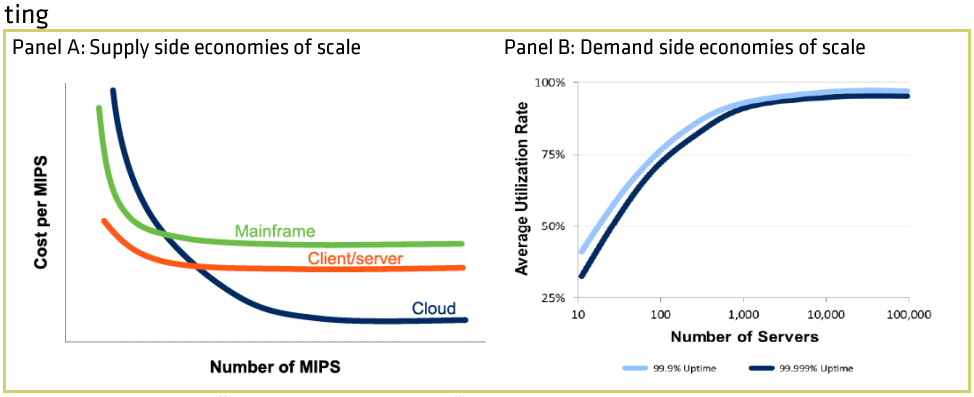
Benefits of cloud computing to the public sector
Cloud computing can bring down costs of

- Office machinery and computers
- Computer and related services
- Reduce costs of "down-time"

This is because of supply side and demand side economies of scale associated with the technology. Supply side economies of scale arise because procurement, operation and maintenance of office machinery and computers are centralized at companies which specialize in the procurement, operation and maintenance of such machinery and the necessary software. This drives down costs. Demand side economies of scale arise because when a large number of different users pool their usage of CPU and storage, server use may become more efficient. For example, if there is only one user, server capacity has to be adequate to the individual user's maximum need for capacity, even though this maximum is only used rarely. With more users, the peak capacity needs differ, so that one user needs much capacity while others need little. This way, capacity can be adequate for all, while still being used to its full most of the time. The two kinds of economies of scale are illustrated in Figure 3.2. In the leftmost Panel A, supply side economies are illustrated in the way that the cost of computing capacity declines as capacity increases, and even though cloud computing may be more costly for very low capacity levels, it is more cost-effective for most capacity levels. In the rightmost panel

B, demand side economies are illustrated in the way that as the number of servers increases, the average utilization rate increases. This means that if a public institution pools its resources with other institutions or companies, everyone can save costs, because together they will need less capacity than the sum of the entities together.

Figure 3.2 Supply side and demand side economies of scale from using cloud computing



Note: MIPS means "Million Instructions Per Second".
Source:Microsoft (2010).

Cloud computing offers other benefits besides cutting costs. It also offers a common platform for different public sector systems and employee groups, allowing for better sharing of data and resources, and providing easier access to these. This allows for better public service. Furthermore, cloud computing may offer a more stable service, which can tolerate large and rapid increases in the use of public information systems. For example, in the case of heavy rains or snow, which closes down roads, the number of visitors to public traffic information sites may cause locally managed sites to shut down, blocking access to vital traffic information. Cloud computing can help avoid this, because of the greater computing resources available in the cloud.

Besides cutting costs and improving quality, cloud computing also facilitates liquidity management in the public sector, because it saves on investment costs. Instead of investing large blocks of money in new equipment and software at different time intervals, cloud computing smoothens the cash flow because users buy a service flow, which is more evenly distributed over time. This may in particular be an advantage to heavily indebted countries such as Belgium and Italy.

Cloud offers significant savings on IT spend in the 10 countries considered – we estimate a total of Euro 3.3 billion per year in reduced capital expenditure and operational expenditure. The estimate is based on a study by CEBR (2011) which finds savings in order of magnitude of 1.6 to 2.6 billion Euro over a five year period in Spain and Italy.[1] This corresponds to a

[1] C.f. CEBR (2011): *The Cloud Dividend: Part 2 – The economic benefits of cloud computing to business and the wider EMEA economy. Comparative analysis of the impact on aggregated industry sectors.*

savings rate of 18-28% per year in the countries. We assume the relative savings per cent applies to the 10 countries of our study.

The Euro 3.3 billion is a lower-end estimate of the gains from cloud computing – it is based on available evidence, which does not include estimates of productivity gains in public institutions. To get an idea of the types of gains, consider that in democracies like those we are looking at in this report, government changes periodically. A change of government often implies medium-scale reorganizations of the public sector: Some ministries, departments or institutions are merged, others are split. Generally, when this happens, there is a transition period which can last more than a month, where internal ICT systems are not functioning optimally - resulting in many man-years of lost or in-optimal work. This could be avoided because of the scalability of cloud computing.

Benefits of Unified Communications to the public sector

Unified Communication can save costs on transport and post and telecommunications. This is because use of teleconferencing implies less need for travel – both between different divisions of the individual public institution and between the institution and its users. If an institution already uses external usage-priced services for web conferencing, it can reduce costs by moving to an in-house solution.

Shift from fixed line phones to computer-based solutions lower administrative costs because there is no need for technicians when moving, adding or changing phones for employees. Box 3.1 provides an illustration of these benefits from a concrete case in the Danish railway network operator, Banedanmark.

Box 3.1 Case from the Banedanmark – the Danish railway network operator

Banedanmark has implemented both cloud computing and unified communications in collaborating with Microsoft.

In case of bad weather, e.g. heavy snowfall, many citizens will try to access traffic information. This often made the old homepage break down and in 2010 Banedanmark therefore decided to move the traffic information to a cloud based solution based on Microsoft Azure.

The cloud based solution is more flexible, scalable, faster and more reliable than the existing solution. It therefore ensures that citizens can always access traffic information, even when demand is high.
The experiences with moving trafikinfo.dk to the cloud made Banedanmark consider moving the entire website to the cloud as well as considering renting software through a cloud.

The unified communication solution Lync was implemented in 2010 after testing the technology for a couple of years. The reason for implementation was a wish to use the new technology, which was already available to Banedanmark. In addition to this Banedanmark saw cost-reduction possibilities. For example it meant reduced need for technicians when moving employees within the work place as the telephones did not need to altered.

The solution has meant greater flexibility for employees. The presence-part implies that it is always possible to see who is available, which makes it possible to work from home or other parts of the work place without losing contact to colleagues. In addition many questions to colleagues are handled via the chat function, reducing the need for long, time-consuming emails. The improved availability also facilitates communication with business partners and costumers as they can easily get in contact with the relevant person in the organisation.

It has been difficult to estimate the savings from improved availability, whereas travel savings can more easily be estimated. By increasing the amount of video conferences Banedanmark estimates that they can save 20,000 Euro per year on travel per leader group of 10 persons.

Source: " Banedanmark smed telefonerne ud", article on Marketit.dk 14-03-2012.

There is also documentation for economic gains from Unified Communications. Microsoft alone has collected more than a hundred case studies documenting the value of unified communications for clients. Regardless of whether the clients are public or private they all point to the benefits of improved productivity, cost reductions, improved reliability and improved communications within the organization. There is, however, not any systematic statistical evidence for public sector benefits from unified communications. We think, that it is reasonable to transfer effect estimates from studies of how unified communications benefit the private sector, because the large body of case study evidence from Microsoft shows that the benefits to public and private institutions are of the same types. Danish Technological Institute (2010) conducted a survey of about 900 Danish firms, of which a little more than half already used unified communications to some extent. The study found that savings on travel expenditure in the private sector would sum to more than DKK 3 billion (Euro 400 million) and value of saved working time would total more than DKK 1 billion. We have estimated the relative gain for the Danish firms and transferred the relative gain to the three public sectors in the ten countries we consider. The result of the estimation is shown in Table 3.1. The table shows that the total benefits from saved transport costs, costs of communication and improved productivity will be in the neighborhood of Euro 3 billion in the ten countries for the three public sectors we consider.

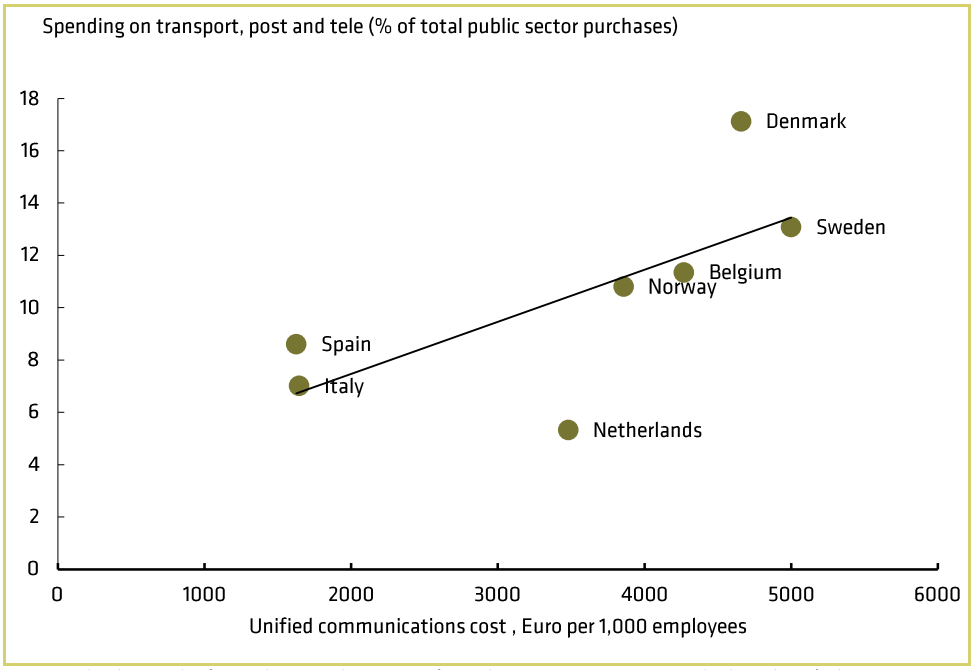
Table 3.1 Benefits from unified communication

	Per cent	Total, million Euro, for 10 countries, 2010
Travel costs	8.8 of input from transport	578
Post and telecommunications	8.8 of input from post and telecommunications	1,427
Productivity	0.1 of GDP in health, education and public administration	954
Total		2.958

Source: Own estimation.

Based on the above, we would expect that the more a government or institution spends on transport and post telecommunications, the more it has to gain from using unified communications.

Figure 3.3 Spending on transport, post and tele, and spending on unified communications



Note: The data in the figure show combinations of spending on transport, post and tele and unified communications for Belgium, Denmark, Italy, Netherlands, Norway and Spain. Spending on transport, post and tele are measured as a per cent of total government input. Spending of unified communications is measured in Euro per 1,000 employees.

Source:Eurostat supply-use and input-output tables, and Microsoft.

The available data also seem to support this. Figure 3.3 shows the share of public inputs that come from transport, post and telecommunications sectors, in relation to the public spending on unified communication. The figure indicates that countries which spend a relatively large share of total public expenditure on transport, post and telecommunication also spend a relatively large amount of money per employee on unified communications. One might suspect that this finding may to some extent reflect that some countries just have high public expenditure in general. However, this is not the case. In terms of Euro per inhabitant, Norway is by far the biggest public spender among the countries we consider. For example, if the countries in the figure are ranked in terms of their spending on unified communications, Norway is number 4 out of the seven countries.

Benefits from cloud computing and unified communications – the case of Denmark

The public sector savings in Denmark amount to approx. Euro 709 million per year. This consists of approx. Euro 460 million in savings from use of cloud computing and approx. Euro 249 million from use of unified communications.

The savings from increased use of cloud computing arise because of reduced spending on ICT capital equipment, reduced spending on ICT operations and reduced spending on power and cooling. These savings have been transferred from a study by CEBR (2011), which estimates them over a five year period for France, Germany, Italy, Spain and the UK. CEBR (2011) finds the cumulated five year saving to be Euro 1.6 billion for Spain and 2.6 billion for Italy, corresponding to annual savings of Euro 0.3 and 0.5 billion repectively. From the Eurostat supply-use tables we find total input from the computer, electronic and optical equipment sector and the computer programming and consulting sectors to Spanish and Italian public administration, health care and education. These costs add up to approx. Euro 1.8 billion in 2010 in each country. The annual saving due to cloud computing is therefore 18-28 per cent of total government ICT spending with an average of 23 per cent. In the case of Denmark, the corresponding public ICT expenditure is estimated to be Euro 1.9-2.5 billion, depending on the assumed growth rate 2007-2010.[2] 23 per cent of the 1.9 billion Euro is 460 million Euro.

The savings from unified communications equals approx. Euro 90 million from reduced costs of travel in the public sector, approx. Euro 112 million from reduced costs of postal services and telecommunications, and approx. Euro 48 million from increased productivity because public sector employees save time from reduced travel. These savings are based on estimates of cost savings for private companies estimated by Danish Technological Institute (2010). We combining these estimates with information about total value added in Danish

[2] The historical growth rate of Danish ICT expenditure in public administration, health care and education was approx. 10.5 per cent per year from 2004-2007. If we assume this growth rate continues, Danish ICT expenditure in the mentioned sectors will be approx. 2.5 billion in 2010. If we use a more conservative estimate of the ICT expenditure growth rate, we arrive at an estimated expenditure of 1.9 billion. We use the conservative estimate as the basis for estimating cloud gains.

firms and Danish public administration, health care and education sectors, to arrive at our estimates.

Summary

To summarize the chapter, we started from the finding in chapter 2, that the countries face a challenge with respect to funding public expenditure in the future. Then we described how cloud computing and unified communications can contribute to reducing costs, and we estimated the economic importance of some of the gains. The gains we estimated are lower-bound estimates, because a range of the potentially most important benefits cannot be quantified on the basis of the existing studies and data. However, we still find net savings in public administration, health care and education of approx. Euro 6.2 billion in total in Denmark, Finland, Norway, Sweden, Belgium, Luxembourg, Netherlands, Portugal, Spain and Italy. A main challenge associated with estimating the gains from the technologies is that there exists little statistical evidence on how the technologies impact the institutions which use them. This means that many gains are difficult to quantify, and any quantification will be uncertain.

Chapter 4 BARRIERS TO THE TAKE-UP OF NEW TECHNOLOGY IN PUBLIC SECTOR

Key findings:

- Economic incentives to take-up cost-saving technologies in public sector are limited: For each Euro saved by a public institution, less than half goes to the institution itself.
- Regulatory barriers against use of cloud computing are strong.

In the last chapter we saw that there are important gains to be had from using cloud computing and unified communications. We also saw that the countries which we expect would gain most also tend to invest more in the technologies. In this chapter we look into how much the public sector uses the technologies and the barriers that exist for the take-up of new technology in the public sector.

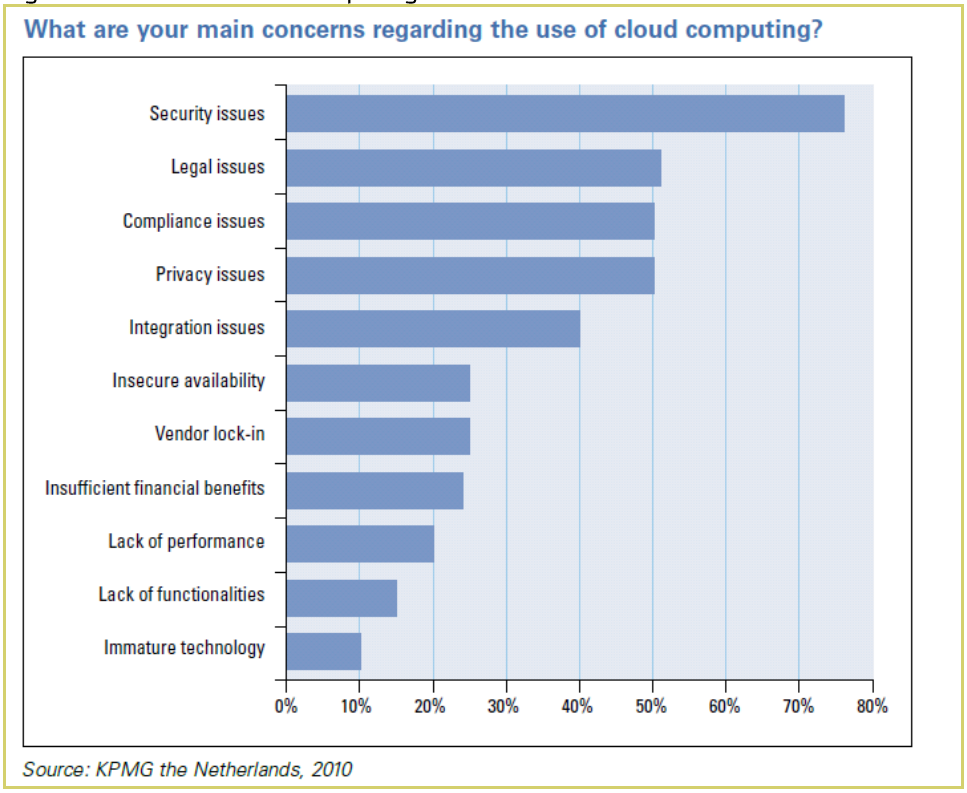
It seems that the public sector is adopting cloud computing and unified communications at a slower speed than the private sector. A recent study by Rambøll (2011) surveyed the use of cloud computing in Danish private companies and public sector institutions. They distinguished between private clouds, public clouds and shared private clouds, where a group of companies or institutions share a private cloud. The responses show that in Denmark, the take-up rate of public cloud among private companies (13%) is twice as high as that of public institutions (6%). Private companies also have a take-up rate of private cloud solutions, which is 25% higher (25%) than the corresponding take-up rate of public institutions (20%). These findings are mirrored in a study by KPMG (2012), which finds that the general take-up rate of cloud services among public institutions in EU is low. The leading countries in EU are Denmark and Italy with take-up rates around 30 per cent.[3] Netherlands and Spain have somewhat lower levels, 18% and 14%, respectively.

We have not found similar statistical evidence on the take-up of unified communications, but the expenditure data we have suggest that there are great differences in the take-up of this technology among the countries we consider, c.f. last chapter.

The relatively slow take-up may be due to some barriers to new technology, which are important in the public sector, but less important in the private sector. KPMG (2010) asked public institutions what they perceived as barriers to taking-up cloud computing. The study found that security issues and legal issues were main concerns, while concerns about technological readiness and functionality were relatively minor concerns. The full list of barriers is presented in Figure 4.1.

[3] Take-up is defined as having a fully implemented cloud solution.

Figure 4.1 Barriers to cloud computing



Source: KPMG the Netherlands, 2010

For the purpose of this study, we consider it useful to distinguish between three types of barriers: Attitudinal, economic and regulatory barriers. Attitudinal barriers are related to the feeling on insecurity from losing control of ICT system performance. When ICT services are outsourced, as is the case with cloud computing, the firm's or institution's ICT responsible cannot himself/herself do anything when system performance declines. He or she has to ask the external service provider to fix the problems. This may cause ICT managers to become insecure. Other attitudinal barriers may have to do with public institutions not wanting to shed labour when it outsources services. Economic barriers are related to the costs and benefits perceived by the individual decision maker – in contrast to the costs and benefits at the level of the entire organization or more broadly: Society. An example of an economic barrier is that the office or department which saves money by moving into the cloud or adopting unified communications may not itself get any share of the gains. Maybe the office or department will even have its budget and staff cut if it saves money. Regulatory barriers are related to laws and regulations setting up limits for the use of technology. Well-known examples of regulatory barriers include specific national rules and regulation i.e. on storage of data and difficulties to process data outside of EU.

Attitudinal barriers

We have no summary information on attitudinal barriers to cloud computing and unified communications in the countries we are considering. However, at a general level we expect

that attitudinal barriers to cloud computing and unified communication will decline as the technologies become more widely adopted, and more people get experience using them. Already now the use of cloud computing and unified communications is becoming widespread in the private sector, and with general circulation of labour, attitudinal barriers to the technologies will diminish in the public sector as well.

Economic barriers

We have done in-depth studies on the funding structure of public institutions within health care and education in Spain and Denmark. We analyzed to which extent costs savings or productivity increases in health care and educational institutions benefit the units which decide to implement them. We classified each layer of the health care and educational systems according to whether institutions' funding is linked to their results, that is, e.g. so-called "fee-for-service", "taximeter" or other funding systems. We transformed this classification into a comprehensive indicator for the entire health care and educational systems based on the share of public expenditure in the different layers. Our findings suggest that when a public institution saves 1 Euro, it only gains between 0.1 and 0.55 Euro for itself. Generally, the incentives for cost saving and productivity enhancement are better in Denmark than in Spain, which also squares well with the finding that Denmark is ahead of Spain with respect to taking up cloud and unified communications. However, though some parts of the public sector appear to provide better incentives to take up new technology, there still remain barriers to public sector take-up of new technology in both Denmark and Spain.

Table 4.1 Indicator of strength of incentive to save costs and increase productivity in public sector

Strength of incentive to increase productivity		
	Denmark	Spain
Education	0.36	.
Health care	0.55	0.1

Note: A value of 1 would indicate that a Euro saved is also a Euro earned for the institutions which decide whether to adopt new technology. '.' Indicates a missing value.
Source:Own estimation. Further details are available from the authors on request.

Regulatory barriers

The main such barriers have to do with specific national rules and regulation i.e. on storage of data and difficulties to process data outside of EU. Furthermore, the specific details or such regulation differ from country to country, currently, which also causes barriers. We are

not aware of regulatory barriers to the use of unified communications, but they are relevant for cloud computing.

EU is currently considering a common regulation regarding data security. The draft regulation we have seen points in the direction of a more harmonized regulation, which by itself serves to reduce the barriers. However, the improvement due to better harmonization may be counterbalanced by an increase in the overall strictness of the data security regulation and by new uncertainty relating to e.g. which country is the country of main establishment – which defines the public regulatory body which is responsible for supervising a company.

In this chapter we described and quantified some of the barriers to the take-up of cloud computing and unified communications in the public sectors in EU. We assess that in particular economic barriers are important, but that regulatory barriers are also important.

Chapter 5 BETTER FRAMEWORK FOR TECHNOLOGY IN THE PUBLIC SECTOR

Key findings:

- There is no quick fix to ensure take-up and optimal use of IC technology in the public sector. The barriers have root in fundamental incentive problems in the public sector.

- Better funding structures, better ICT skills, and better broadband infrastructure are all prerequisites for cloud and unified communications, but bring many more benefits besides those gained through cloud and unified communications.

So far, we have outlined the future fiscal challenges which a group of European countries will face in the medium term. We have pointed to new information and communications technology as part of the solution to maintaining a high quality level for public services, while reducing public expenditure. In chapter 4 we pointed to a set of barriers to the adoption of unified communication and cloud communication. Some of the barriers described will affect any kind of cost-saving investment or initiative in the public sector. In this chapter we propose some policy directions which can lead towards a more valuable, productive and cost-efficient public sector.

Unified communications and cloud computing should be considered as ways to provide better public services at lower costs, because there is reason to believe that the technologies can achieve this, and because there is a growing body of evidence to support that the technologies do in fact achieve it. There may be cases where the gains cannot justify that some institutions use the technologies. But for many institutions, there is a good economic case for adopting them.

Decisions to adopt or not to adopt the technologies should be founded on an analysis of the economic costs and benefits for society. That is, the individual public institutions should not only consider the costs and benefits for themselves, but also the costs and benefits for the rest of society. For example, if a new technology saves costs for business due to e.g. faster or better case handling, then this may justify its adoption even though the technology involves an increase in the institution's costs. The socio-economic costs benefit analysis needs to take into account the full range of costs and benefits which adoption of the technology has on society.

The economic barriers described in this report arise when decision makers do not take into account what the costs and benefits of a technology are for society. The solution to the problem involves a combination of better information on the benefits for society, and better incentives for decision makers to pursue the interest of society. One way to improve these incentives is to link institution's budgets to their performance rather than to their cost base. This is possible in many types of public institutions which produce goods and services similar to those produced on the market, that is for instance, many types of institutions in the health care sector, and many types of institutions in the education sector. Already now, many countries use taximeter systems in parts of their education sector, and DRG-systems in

their hospitals and in primary care. These systems are not necessarily perfect, but they provide an incentive to reduce costs and improve productivity. Another way to improve the incentives is to centralize decisions about purchases of technology. A centralized decision maker whose job it is to make decisions in society's interest, and who does not experience reduced budget when new technology saves money, can be expected to have greater incentive to implement cost saving technology. The disadvantage of centralized decision making is that it may lack information of the local needs and opportunities. There is a difference between being in the local reality with a first-hand impression of what costs money and hampers service delivery, and reading business cases about new technology adoption. A third way to improve incentives is to set aside targeted funds for new technology in the public sector. This can be used to reduce the costs of acquisition and implementation to the local institutions, which will improve their incentives to adopt it. However, if the local institutions still perceive that budgets will be cut when they adopt new technology, then incentives for technology adoption will still be imperfect.

An increased take-up of cloud computing in the public sector also necessitates a resolution to the data security issues associated with the use of cloud computing in the public sector. There are both regulatory barriers which spring from data security issues, but there are also barriers which originate in concerns that public data may become less secure. The former type of barriers necessitates a revision of regulation. Such a revision is currently under development in the EU. The latter type of concern may be mitigated by a certification scheme, where cloud service providers are subject to a comprehensive audit of their data security, and can be certified for meeting certain requirements. In a survey conducted by KPMG (2012), 80 percent of public sector ICT decision makers said that they would be more confident if cloud services were certified by a public body. Certification schemes have a potential for removing uncertainty on the part of public sector ICT purchasers. However, the design of certification schemes is not without pitfalls: If private firms supply the certifications, there is the risk that they will not be entirely independent of the firms they are certifying, c.f. the recent debate on the role of credit rating agencies in the current world financial crisis (see e.g. Mathis et al. (2009)). If public bodies supply the certifications, there is the question of which country or countries should perform the certifications, and how to design public institutions which have incentives to supply high-quality certifications in a cost-efficient way. A review of the specific types of incentive problems which apply to the public sector is given in Dixit (2002).

Besides the regulatory "infrastructure" described above, physical infrastructure is also necessary in order for cloud computing and unified communications to achieve their full potential in the public sector. Both the technologies require high levels of broadband capacity: cloud computing involves a large share of public sector data transmissions to take place over the internet, rather than within local networks in the public sector. Unified communications do not by themselves imply an increase in internet traffic, but they facilitate video meetings, which is part of what makes the technology economically attractive. Video meetings require more broadband capacity than audio communication and written communication. As the

technologies become more widespread and their use increases, increased broadband capacity may become necessary. In order to achieve the full potential of the technologies, it may be necessary to consider revising the regulation of internet traffic, the framework conditions for private investments in broadband infrastructure, and possibly also consider public investment in broadband infrastructure.

Finally, cloud computing and unified communications require a minimum level of ICT readiness on the part of the public sector employees and of the general population. A great part of the economic potential of unified communications lie in the ability to communicate with citizens, firms and other parts of the public sector without having to be in the same location. This requires that all parties must be able to use unified communication and have the necessary equipment. Bringing public sector employees' skills to the necessary level is a matter of training, which can be handled within the public sector through the use of courses and on-the-job training. In addition to raising the ICT readiness of employees, it is a prerequisite for reaping the benefits from unified communications and cloud computing that the employees actually take up the technologies. This is a leadership task. A recent study by Det Digitale Råd (2011) describes this issue in depth. Private sector employees can be expected to gradually increase in ICT readiness as cloud and unified communications become more widespread. However, for persons without a job, it is a challenge to lift their ICT readiness to the necessary level. If the public sector wants to exploit the potential of unified communications, a strategy and a list of initiatives is necessary for making the general public ready for the technology.

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APPENDIX: CALCULATED SAVINGS FROM UC AND CLOUD IN INDIVIDUAL COUNTRIES

Table A.1 Savings from unified communication and cloud computing

Million Euro, 2010	Travel cost savings	Travel time savings	Postal+telecon savings	Cloud savings	Total
Austria	18,6	54,9	48,5	47,4	169,3
Belgium	14,5	80,8	84,8	272,5	452,6
Denmark	89,1	48,1	112,2	459,9	709,3
Finland	55,7	214,1	89,2	187,6	546,6
Ireland	41,5	31,8	36,6	159,6	269,6
Italy	57,9	296,4	389,7	423,5	1167,5
Luxembourg	0,3	33,6	3,6	12,4	49,9
Netherlands	48,6	8,5	162,9	509,4	729,4
Norway	57,1	122,1	45,7	601,0	825,9
Portugal	26,2	34,4	41,1	58,8	160,5
Spain	141,6	62,7	342,0	409,8	956,1
Sweden	87,5	52,9	155,2	317,3	612,9
Switzerland	38,5	73,9	70,0	117,5	300,0
Total	**677,1**	**1.114,2**	**1.581,7**	**3.576,5**	**6.949,5**

Source: Own calculations based on data from EUROSTAT and OECD among others.
Note: The calculations for all of the countries, except Switzerland, is based on EUROSTAT data, whereas the Swiss data is from OECD.