STATE OF THE DIGITAL REGION / 2016

CITIES CONNECTING THE DIGITAL ECONOMY IN THE BALTIC SEA REGION

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sustainable growth innovation competitiveness
Baltic Development Forum
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top of digital Europe

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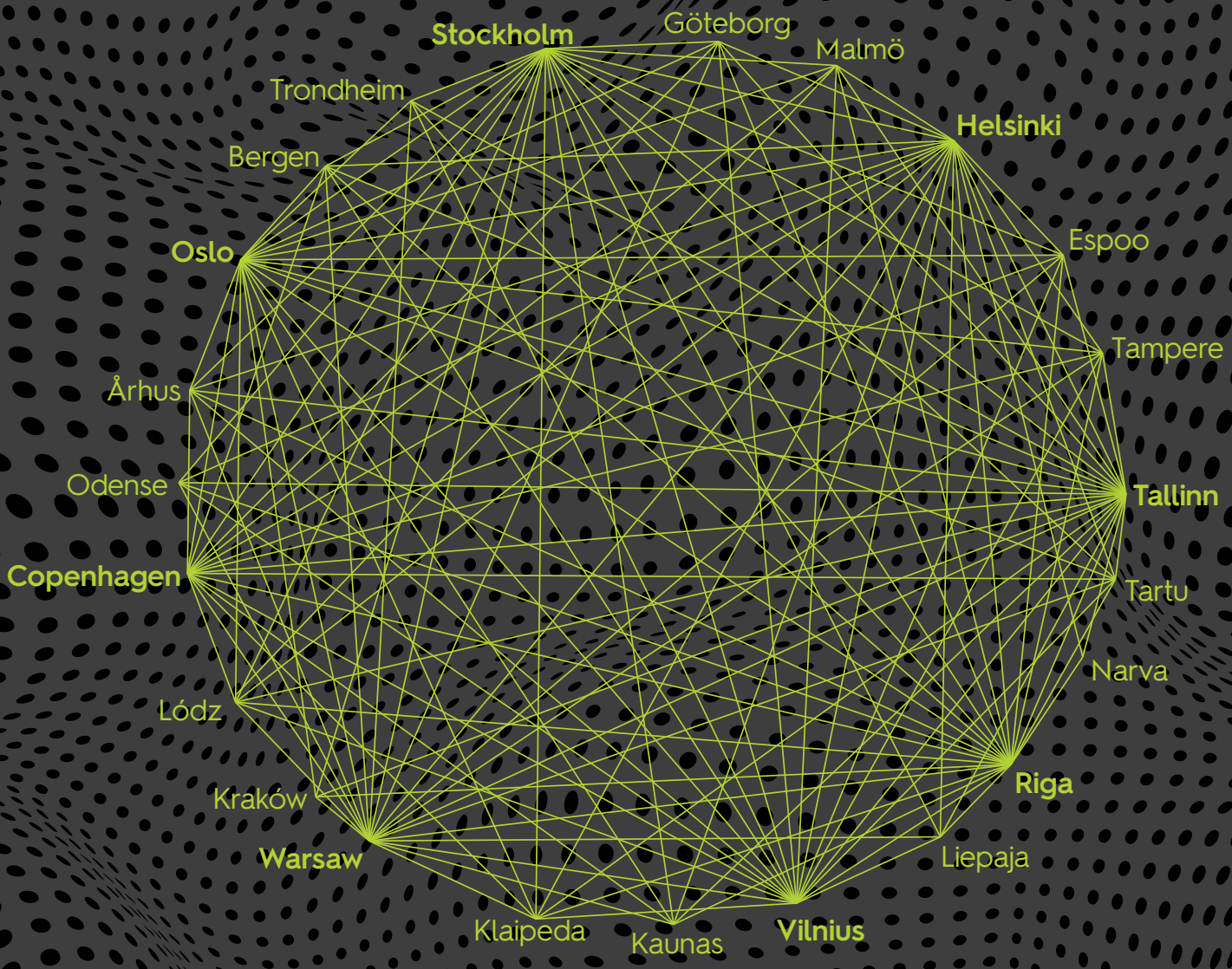
STATE OF THE DIGITAL REGION 2016

Cities connecting the digital economy in the Baltic Sea Region



FOREWORD

We are pleased to present the 2016 State of the Digital Region report, the second edition of Top of Digital Europe´s annual overview of achievements and potential of the Baltic Sea Region within the digital economy. The State of the Digital Region report has received considerable attention and acknowledgement across the Baltic Sea Region. With the second edition, we look forward to continuing the active dialogue with key stakeholders among businesses and policymakers on how to fully take advantage of this region´s potential in the digital economy.

With an annual up-dated overview of the region´s achievements, we are able to track on a yearly basis new trends and developments in the region´s digital economy. Adding Norway to this year´s report provides additional insight into the digitalization potential of the Baltic Sea Region.

This year´s edition re-affirms that the countries in the region are frontrunners in many aspects of the digital economy. But it also confirms that the countries need to step up if the region is to stay in the lead as a global ICT hub. Stronger macro-regional cooperation will benefit all countries in the region, also those in the lead, and inspire and support the implementation of the EU digital single market. The paper also presents a special thematic analysis on the role of cities and city-to-city networks in integrating a digital market in the Baltic Sea Region and beyond.

The State of the Digital Region is based on a unique set of data collected from many international sources. All data presented in the report are made available for further study on Top of Digital Europe´s webpage www.topofdigital.eu.

We would like to sincerely thank the research team behind the report, Professor Martin Andersson from Blekinge Institute of Technology and Lund University, and Ph.d. candidate Joakim Wernberg from Lund University for their excellent presentation of challenges and opportunities for a digitalized economy in the Baltic Sea Region.

Enjoy the read!

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● The first State of the Digital Region report in 2015 introduced the idea of macro-regional bottom-up collaboration as a complement to national and EU-wide initiatives towards a digital single market. We build on that idea in two ways: First, the data used to measure the digital state of the Baltic Sea Region (approximately 1500 indicators) is updated and Norway is added to the study. Second, this year's report focuses particularly on the role of cities as forerunners both in digitization and in connecting markets across borders.

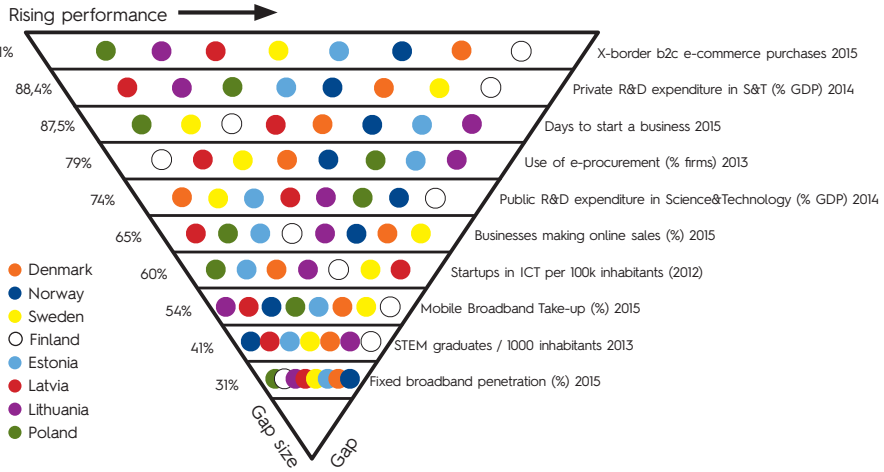
THE UPDATED STATE OF THE DIGITAL REGION

● Estonia continues to show strong development and is the overall fastest mover in the region. It is converging or levelling with the Nordics in several categories. Estonia is also leading on e-government development.

● A worrying development is that Latvia, Lithuania and Poland still lag behind in some key categories and do not show any signs of picking up the pace. With the current speed it will take too long for them to converge to the levels observed in Estonia and the Nordics. This is a considerable issue since user connectivity drives demand for digital solutions as well as for new digital services.

● Sweden exhibits only slow development in terms of both cross-border e-commerce and e-government. It is a digital leader in many regards, however if Sweden slows down or stagnates others will catch up and surpass them.

● The updated gap size graph gives a snapshot of the digital gaps in the region



CITY NETWORKS IN THE BALTIC SEA REGION (BSR)

● Historically, cities have played key roles in promoting trade across the Baltic Sea. The Hanseatic League was dominant in maritime trade from the 11th to the 16th century. Today, networks between cities with strong digital and technology-driven economies provide a vital link in bridging obstacles related to integrating digital markets.

● Urbanisation and digitisation are intertwined. Both trends contribute to lowering the cost of interaction between people, but they complement rather than substitute each other. Digitalisation facilitates established long-distance contacts (global pipelines), while urbanisation facilitates local interactions with both established and new relationships (local buzz).

● Baltic Sea Region cities could form a Digital Hansa to promote innovation, entrepreneurship and growth through the flow of information, ideas and human capital between urban economies. Together, they have many of the components of what would be a formidable tech cluster. By being connected to each other, these cities could also become more attractive to global cities outside the network.

● Cities provide fertile ground for innovation- and tech-driven start-ups. They form hubs in the digital economy by generating large amounts of data, concentrating tech-driven innovation and linking physical and digital connectedness. Cities like Stockholm, Copenhagen and Tallinn have unique start up environments that draw global attention. Together, they would not only benefit from each other, but also form a more complete competitive global start up scene.

POLICY PROPOSALS

● Policies to advance city-to-city networks need to enable local buzz within cities as well as supporting global pipelines between cities. The buzz proposals focus on controlled experiments, while the pipeline proposals focus on city-to-city partnership agreements.

Local buzz policy

● Baltic Sea Region city leaders should conduct controlled experiments in their cities together with start-ups and researchers, for instance by allowing self-driving cars, testing drone deliveries, or using sensors to measure climate impact. These experiments would not only create vibrant testbeds for start-ups, but also provide valuable intelligence for future policy formation. Practical policy could include installing a Chief Data Officer in the Mayor's office, create testbeds for new technologies, adapt procurement processes to promote urban innovation, and provide access to high-quality open government data.

Global pipelines policy

● Baltic Sea Region city leaders should promote and support networks between tech-driven start-ups, innovators and entrepreneurs in different cities in different countries. Practical policy proposals in this vein include exchange programs for tech-driven start-ups between Baltic Sea Region cities, use science parks or incubators as platforms for incoming start-ups and connect these science parks through a Baltic Sea Region start up exchange network. It also includes means to offer temporary offices to visiting start-ups, as well as using e-procurement to reach and attract innovators and small firms in other cities and countries.

1 INTRODUCTION

With the first State of the Digital Region report in 2015, we introduced the idea of leveraging macro-regional bottom-up collaboration as a complement to national and EU-wide policy initiatives aimed at creating a single digital market. The report provided a unique overview of the current state of digitisation in the Baltic Sea Region (BSR) countries, based on over 1500 sets of data indicators. The BSR contains some of the digital forerunners in Europe, some of its quickest movers in terms of embracing new technologies, and one of its largest domestic markets. Against this background, the BSR constitutes an important hotbed for growing and cultivating a cross-border digital market with the ambition to explore possible policy measures, to iterate and learn, to share experiences and to scale up successful initiatives.

In this year's report we continue to build on these ideas in two ways. First, it presents updated graphs and tables on the overall digital development in the region, focusing on identifying main changes and trends. To this end, we study the same set of data as last year, but add additional years of observation. A novelty in this year's report is that the analysis – in addition to Denmark, Sweden, Finland, Estonia, Latvia, Lithuania and Poland – also includes Norway[1]. As we will see, Norway is a country that on many indicators is a forerunner in the digital economy, and a strong potential contributor to macro-regional cooperation in the Baltic Sea Region.

Second, we focus on the cities in the region. Urbanisation and digitisation are intertwined and interacting trends, and the BSR cities can exploit complementary advantages and joint synergies by developing cross-border inter-city networks. Cities constitute hubs of human capital and provide proximity between people and firms located within them. They also form central nodes in the digital economy by generating large amounts of data, concentrating tech-driven innovation and linking physical and digital connectedness. Therefore, they provide fertile grounds for innovation- and tech-driven start-ups. This also makes them key players in a macro-regional cross-border networks in the digital economy. Using recent data on cities in the BSR countries, we show that BSR cities have many of the components of what would be a formidable tech network "cluster" of cities.

The report launches the idea that cities in the Baltic Sea Region could engage in city-to-city partnership agreements to promote innovation, entrepreneurship and growth through the flow of information, ideas and human capital between urban economies. This idea connects to historical patterns in the region. The Hanseatic League, a confederation formed during the late middle ages by merchant guilds and cities, was for example in all essence a network of cities that dominated maritime trade between the 11th and the 16th century. Although the example is old, the idea that cities could be the standard bearers of cross-border collaboration is more important today than ever before.

The rest of the report is organised as follows: Section 2 presents the updated data on the digital state of the region. It focuses on reporting main changes and developments since last year's report. Section 3 introduces the ideas of cross-border city networks. This section covers the bond between digitisation and urbanisation, the role of cities and urban growth, the concept of city network and finally the potential for forming cross-border city networks in the BSR. Section 4 provides policy suggestions.

[1] Due to practical reasons Germany is not included in the analysis

2 Revisiting the State of the Digital Region

As last year, we have collected and mashed up data from some of the largest and most up-to-date databases available. The analysis is based on data from the European Commission, OECD, World Bank, International Telecommunications Union (ITU), World Economic Forum (WEF), Eurostat and International Labor Organization (ILO). A complete list of updated graphs and figures are found in Appendix 1. Section 2.1 presents main trends and changes in the updated data set. Section 2.2 summarises and presents an updated gap graph to illustrate the relative levels of development between countries in the region

2.1 WHAT'S NEW?

We begin by studying the development according to broad indicators on use and penetration of digital technologies. **Fig. 1** shows internet users as the fraction of the country population. The majority of the population in the BSR countries are now internet users. In all countries, the fraction of internet users is over 60%. It is clear that Norway, which was not part of the report last year, joins Sweden, Denmark and Finland in the top. The fraction of people that are internet users is over 90% in all three Nordic countries.

In terms of dynamics, we see that Estonia in 2014 has continued to close in on the Nordic countries. Between 2013 and 2014 it increased the fraction of the population that is internet users with almost 5 percentage points. Although the country has not yet reached the same level as the Nordics, it will soon if the development between 2013 and 2014 repeats itself in the coming years. Poland still lags behind all other countries, but shows a positive development trend. It should also be noted that in absolute numbers, Poland by far surpasses the other countries in number of connections. However, realising its full potential requires spreading the availability and uptake of digital technologies throughout the country. It is also troublesome that Latvia show no significant increase at all in the fraction of internet users between 2013 and 2014.

A similar trend appears in the fraction of households that have internet access at home **(Fig. 2)**. The average for the whole EU-28 in 2014 was 81 %. Later data for 2015 show that all countries in the BSR but Poland, Lithuania and Latvia are well above 81 %. Norway has a clear lead in this category. 97% of all the households in the country have internet access.

Another notable development is that Estonia has managed to keep up its significant growth since 2005. The country is now on par with the Nordic countries in several categories, including this one. In 2005, the country was almost 20 percentage points below Finland in terms of the fraction of households with internet access. Ten years later, in 2015, that gap is closed. These results are consistent with the results presented in BCG's report "Digitizing Europe: Why Northern European Frontrunners Must Drive Digitization Of The EU Economy", portraying Denmark, Norway, Sweden, Finland and Estonia as digital frontrunners in Europe.[2] On the other hand, in the most recent report from the Digital Agenda Scoreboard, Denmark, Sweden and Finland are classified as countries that lag ahead. This means that they score above the EU average but their score grew slower between 2015 and 2016 than that of the EU over the last year. Estonia is still classified as running ahead, which means that the country scored above the EU average, while also growing faster in digitisation than the EU average over the last year.

FIG. 1

Internet users (% of population) 2005-2014

(WORLD BANK)

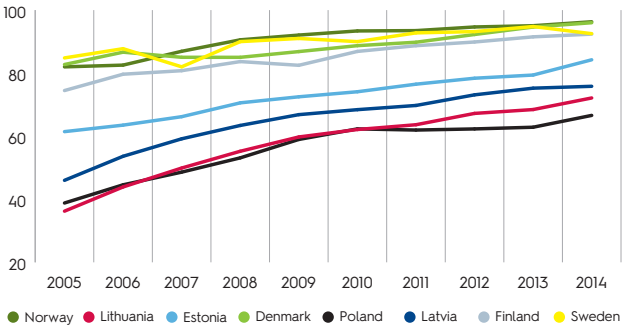
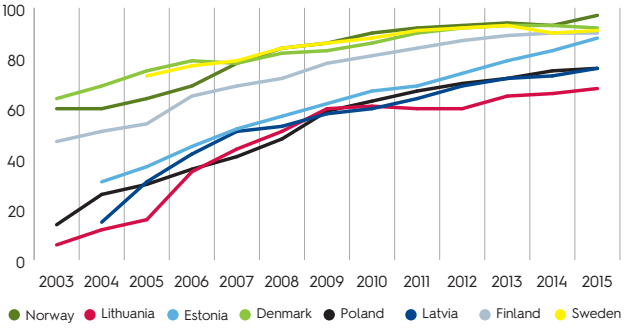


FIG. 2

Households with internet access at home 2005-2015 (%)

(DIGITAL AGENDA SCOREBOARD)



It is also clear that connectivity in Poland, Latvia and Lithuania develops at a much slower pace. The gap between these countries and Estonia has widened considerably, especially since 2012. Lithuania has shown a sluggish development since 2010, though the recent years witness a small and promising increase. On the whole, it is evident that if the pace of the development in Poland, Latvia and Lithuania follows the current trend, it will take a very long time until the countries converge to the level observed in Estonia and the Nordics. This is a considerable issue since user connectivity drives demand for digital solutions as well as for new digital services.

The situation looks different for advanced mobile broadband coverage. **Fig. 3** shows that the process of convergence that started in 2013 is by now 'completed'. In the most recent data, i.e. 2015, it is clear that the differences between BSR countries have more or less vanished. This is indeed a very positive development. Combined with decreasing roaming fees within EU, this provides a strong basis for mobile app services and seamless accessibility across borders.

[2] BCG (2016, p 10): http://image-src.bcg.com/BCG_COM/BCG-Digitizing-Europe-May-2016_tcm22-36552.pdf

Another key development indicator is the fraction of people in each country that has never used internet **(Fig. 4)**. There is still a significant number of people in several countries, notably Poland, Lithuania and Latvia, that are not connected. These countries are the only ones above the EU28 average, which in 2014 amounted to 18 %. It is important to remember that these people are likely to be some of those who could benefit the most from leveraging digital services in their daily lives. We see that Norway again comes out as a forerunner. In Norway, only very few people have never used internet overall, and the country still shows a significant improvement between 2014 and 2015.

Poland, Lithuania and Latvia lag behind the other countries. In both Poland and Lithuania, about 25%, i.e. one in every fourth person, has never used the internet. These numbers stand in sharp contrast to the advancement of the digital economy and a digital single market. While both Latvia and Poland show a significant improvement between 2014 and 2015, Lithuania has stagnated in the sense that the country shows no change. Again, Estonia comes out in terms of dynamics. The county shows a large improvement between the two years.

In the 2015 State of the Digital Region report, significant focus was put on indicators capturing integration through digital markets, such as cross-border e-commerce. Cross-border online shopping in the EU is a direct measure of the realisation of a digital single market. It is also an indicator of the extent to which firms leverage the digital market, because to do so they also need to make transactions online and make themselves available to customers in other countries.

Fig. 5 shows that in terms of cross-border EU business to consumer purchases, Finland and Denmark are in the lead, closely followed by Norway. In these countries, over 30 percent of citizens shop online from other EU countries. In Sweden and Estonia, the corresponding figure is about 25 percent. In Latvia, about one in five citizens shop online from other EU countries. Lithuania and Poland lag behind significantly.

Looking at the changes over time, there are only three countries that show sharp positive development between 2014 and 2015. These countries are Finland, Estonia and Latvia. Estonia came out as a significant runner up in last year's report and has by no means halted its development. On the contrary, as of last year, Estonia is the country in the BSR which shows the strongest development in cross-border e-commerce. It is notable that in 2015, the fraction of citizens that shop online from other EU countries is greater in Estonia than it is in Sweden.

Denmark, Lithuania, Poland and Norway have slightly lower cross-border e-commerce in 2015 compared to 2014, which is a development that is at odds with the advancement of a single digital market. However, Denmark and Norway both fall from a high position, whereas Poland and Lithuania is in a position where the recent development increases instead the gap to the leading countries in the BSR. Compared to 2014, Sweden increased their cross-border e-commerce in 2015, but the country is now back on roughly the same level as in 2013. In last year's report, Sweden was the only country that fell back in terms of cross-border e-commerce.

Another indicator on the extent to which firms adapt to the digital economy is their use of Cloud Computing services **(Fig. 6)**. Available data show that the fraction of firms that use cloud computing has increased in almost all countries in the BSR between 2014 and 2015.[3] Finland takes the lead, with more than 50 % of the firms using cloud computing services. Denmark, Norway and Sweden are on a similar level (between 30-40%), though Denmark shows a small decrease between 2014 and 2015. As a point of reference, the EU28 average in 2014 amounted to 19 %.

[3] Unfortunately, there is no 2015 data available for Sweden and Estonia

FIG. 3

Advanced 3G mobile broadband coverage

(DIGITAL AGENDA SCOREBOARD)

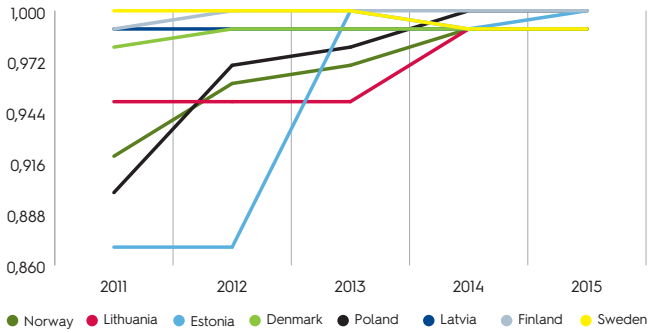


FIG. 4

Percentage of people that has never used Internet in 2014 and 2015.

(DIGITAL AGENDA SCOREBOARD)

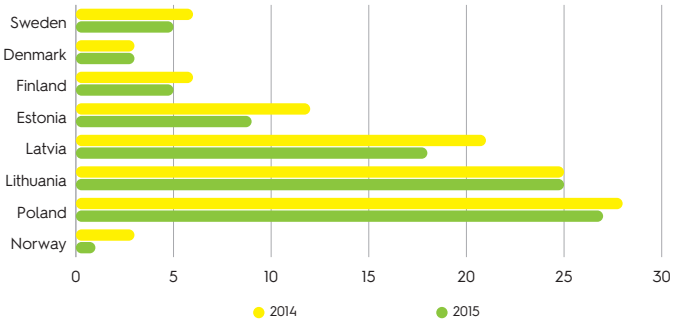
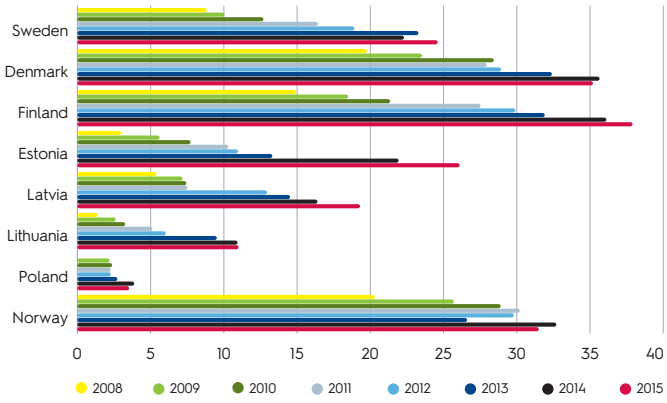


FIG. 5

Cross-border EU business to consumer purchases

(DIGITAL AGENDA SCOREBOARD)



Latvia, Lithuania and Poland lag significantly behind the Nordic countries, but all three countries show an increase. We have no data on Estonia's position in 2015. Given the country's strong development on other indicators, Estonia could be expected to have advanced in cloud computing as well, but the use of cloud computing services is also an area where Estonia's performance has been relatively low. As was pointed out in last year's report as well, the country is roughly at a similar level as Lithuania (2014 data). Given that Estonia has converged to the level of the Nordic countries on many other indicators of readiness for digitisation, one could expect Estonia to have shown a stronger position on the use of cloud computing services in the business sector.

There are rather sharp differences since last year's report with regards to citizens' use of e-government services. There has been considerable development within the area of e-government services in the recent years. A new report on the EU shows that about 81% of public services are available online, though there are still significant differences across countries.[4] For the countries in the BSR, **Fig. 7** shows the fraction of citizens by country that used e-government services in the last 12 months and submitted completed forms to e-government services in the last 12 months.

It is clear from the graph that Denmark is leading in this category. In both 2014 and 2015, over 80 % of the citizens in Denmark used e-government services and over 60 % completed e-government forms. Also, Estonia shows a remarkable increase between 2014 and 2015. In 2014, the country was well behind the Nordic countries in e-government services. By 2015, however, Estonia is on the same level as Finland and Norway when it comes to the use of e-government services, and takes the lead in the BSR when it comes to submitting forms using e-government services. This confirms that Estonia's e-government strategy, including the e-Residency program, is paying off. It is a truly extraordinary development. Sweden, however, scores lower on both indicators of e-government services in 2015 compared to 2014. Sweden is in fact the only country in the BSR showing such a downward trend, although it is admittedly from a relatively strong position.

FIG. 6

Firms use of cloud computing services

(DIGITAL AGENDA SCOREBOARD)

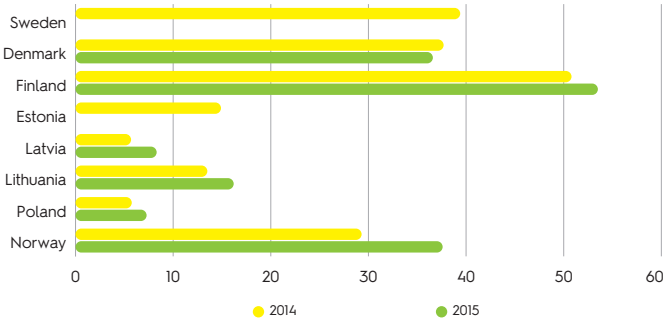
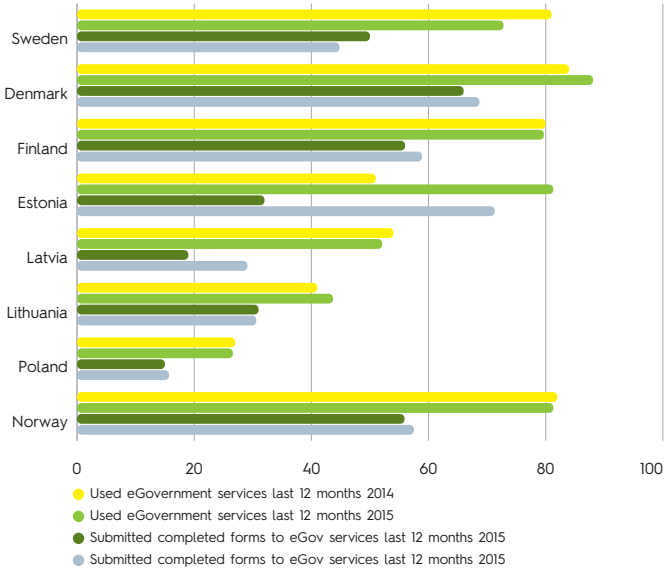


FIG. 7

Share of citizens using e-government services 2014 and 2015

(DIGITAL AGENDA SCOREBOARD)



In summary, there are five key observations in the changes presented in the new data.

- It is evident that Norway has a strong position in the digital economy and ICT in the BSR. Norway teams up with the other Nordic countries on most indicators. It also implies that Norway has a lot to bring to macro-regional collaboration.

- Estonia shows a remarkable strong development in several categories, and is about to converge to the level of the leading Nordic countries with respect to multiple indicators, such as internet users and cross-border e-commerce. Estonia is already in a leading position in the BSR in terms of e-government services as well as Households with internet access at home. Beyond the level of development, Estonia is clearly a leader on progressing digitisation across the economy and society. Although data on 2015 on use of cloud computing is not accessible, available data suggest that cloud computing is one area where Estonia still has to develop and catch-up with the Nordic countries.

- A more worrying development is that Latvia, Lithuania and Poland still lag behind in many categories, and that they show few signs of picking up the pace. With the recent developments, catching up and reaching a digital maturity seems far away.

- Sweden, normally considered a digital leader, shows a relatively sluggish development in terms of both cross-border e-commerce and e-government, although the country is still on a comparatively high level in the BSR. Even so, if Sweden slows down or stagnates, others will catch up and surpass them.

- Poland constitutes as a special case in the BSR. As was pointed out in the report in 2015, Poland is a large country with over 35 million inhabitants, which is an order of magnitude larger than any other BSR country included in this analysis. Accordingly, Poland is often an important player in the digital economy in terms of the sheer number of digitally connected people and businesses, even though they make up only a small part of the country. However, if Poland is to realize its full potential, the entire country has to be included in the digital development.

[4] https://ec.europa.eu/digital-single-market/en/news/eu-egovernment-report-2016-shows-online-public-services-improved-unevenly

2.2 MINDING THE GAPS

At the heart of the State of the Digital Region project lies the ambition to identify and illustrate comparative advantages and opportunities for macro-regional collaboration. In the 2015 report, we introduced a specific gap size graph for this purpose. By mapping the ranking between countries on a variety of key indicators together with the size of the gap between the lagger and the leader, we were able to arrange indicators in order of gap size. The primary purpose of this graph was to illustrate that each country has its strengths and weaknesses, and that the gap between them is not constant neither in size nor in division between countries.

This year, we have updated the gap size graph with the same indicators in order to study how the situation has changed **(Fig. 8)**. Unfortunately, more recent data on two of the indicators was not available, namely startups in ICT per 100k inhabitants and firms' participation in e-procurement processes. Therefore, these two indicators rely on the same data as last year.

In the figure, the size of the gap in terms of the distance between the strongest and weakest performing country is represented horizontally.[5]

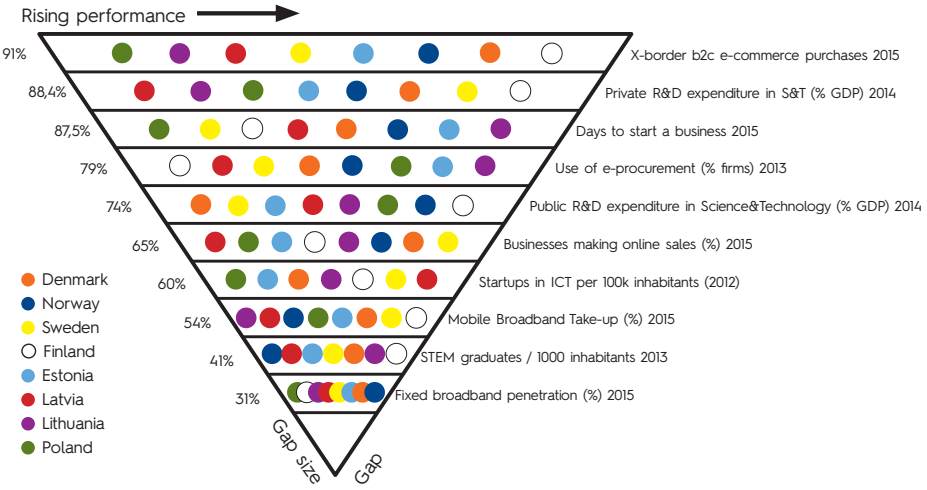
For an indicator placed in the bottom part of the figure, the size of the gap is small. As a consequence, the horizontal distance between the countries is small. This means that size of the gap between the top and bottom is small for fixed broadband take-up. If we instead look at cross-border e-commerce, the gap is large. There is a significant distance between the country with the highest and the country with the lowest score on cross-country e-commerce.

Compared to last year, there are both shrinking and growing gaps.[6] It is evident that the overall smallest gap has grown somewhat, while the largest gap is smaller than last year. In terms of order, the three smallest gaps (in the lower part of the triangle) are the same. ICT start-ups per inhabitants is the same as last year, but due to changes in other indicators it comes in at number four. The gap in online sales has narrowed from just above 73 percent to 65 percent, which is good news. The gap in public R&D expenditure has grown by 1.5 percentage points. The gap in days to start a business has grown by 7.5 percentage points, and the difference between Lithuania and Poland is 26 days. The gap on private R&D expenditure has shrunk from 96 percent to 88.4, meaning that it is no longer the widest gap in the list. Instead, cross-border online purchases show the largest gap with a gap size of 91 percent between Finland and Poland. Even if this gap has only grown marginally, the fact that it is not shrinking casts a shadow on the development of a digital single market.

In summary, the updated gap size graph shows that progress is uneven within the region, and that there are increasing gaps that will need to be addressed in order to advance a cross-border integrated digital market.

FIG. **8**

Gap size graph



3 CITY-TO-CITY NETWORKS

3.1 URBANISATION AND DIGITISATION

Digitisation and urbanisation go hand in hand. With the accelerating advances in digital technologies in the mid 2000´s, it was increasingly believed that places and distances would lose some of their grip on economic development.[7] Both supply and demand would be able to access globally connected markets, price differences would decrease and innovation would no longer be contained in a few places. When you could connect to anyone in the world with a single click or two, it wouldn't matter where you lived anymore. If this were to be the case, it would essentially mean the end of large cities.[8] Why would people pay high housing prices to live in small apartments if we could all live in large houses and connect seamlessly via virtual realities? Yet, since 2014 more than half of the people in the world live in urban areas, and according to a prediction made by the UN the share will rise to 66 percent in 2050.[9] Rather than being flattened out, the world is becoming increasingly spiky as more people move into growing cities.[10]

[5] The gap size is calculated by computing the fraction of the laggard's score divided by the leader's score and subtracting the result from 1. Thus, if the leader has a score of 4 and the laggard has a score of 1, we get 1-(¼)=0.75 (75%).
[6] For the indicator STEM graduates, there is no 2015 data for Poland. Therefore Poland is absent for that indicator.
[7] Cairncross (2001); Friedman (2005)
[8] Johansson et al (2006)
[9] http://www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html
[10] Florida (2010)

FIG. 9

Percentage of people living in urban areas 1950-2050

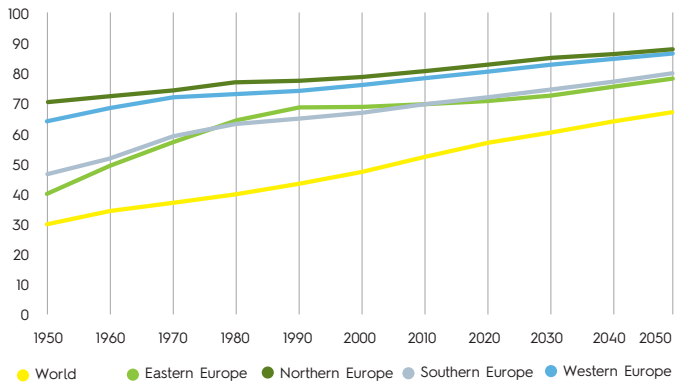


Fig. 9 shows the fraction of people living in urban areas in the world as a whole, as well as in the different parts of Europe from 1950 including estimations until 2050. It is based on data reported by the United Nations in the 2014 revisions of their World Urbanization Prospects. It is clear that there has been a rather steady rise in the fraction of people living in urban areas in the world as well as throughout Europe, and is expected to continue in the foreseeable future. In the northern and western Europe, for instance, the fraction of people living in urban areas is expected to be above 85 percent by 2050. Eastern Europe is moving somewhat slower after a significant rise in the second half of the 1900's. In 2050, urbanisation is estimated to be well above 70 percent. In view of these trends, it is no wonder that The Economist in an article called The world goes to town wrote "... Homo sapiens has become Homo urbanus".[11]

In some ways, the world has indeed become more flat. Digitisation has levelled the economic playing field significantly. In 2010, Hal Varian, chief economist at Google, listed four ways in which computer mediated transactions will fundamentally change business as usual.[12] First, electronic contracts allow for simpler and smarter transactions between firms and individuals. This is what ultimately makes e-commerce more than an optimisation of mail order, or what makes app services like Uber or Airbnb possible. Second, data-driven analysis allows firms to collect data about their customers and processes, often in real time, in order to learn more about their own business. This is what has commonly become known as business intelligence. Third, based on data, businesses can conduct controlled experiments to strengthen their development. That is, their own business becomes their best tool to improve their future performance. According to Varian, Google ran 6000 experiments involving their web search services in 2008, resulting in 450-500 changes to their systems.[13] Fourth, using these new tools firms can offer increasingly customized or customizable products and services.

These four factors - special contracts, data analysis, experiments and customization - were around in some form or another before computers and the internet, but they were mostly small-scale, inflexible and expensive. With digitisation, they are available even to small businesses and start-ups at low cost. Today, each factor can readily be traced in growing businesses such as streaming music and video, ride-hailing apps like Lyft or Uber or for that matter in the potential of the block chain technology. A new and growing type of firms, micro-multinationals, are mobilising international and scalable business models that would have been unfeasible just 20 years ago.[14] Kids are buying Christmas presents for their parents from the other side of the world. Travelers are renting strangers' homes via their smartphones instead of checking into a hotel. Anyone can take a massive open online course (MOOC) from one of the leading universities in the world, sitting comfortably in their favourite chair at home. Even so, most of those kids and firms will be, or are already, in cities.

So why hasn't digitisation offset urbanisation? Because they are not opposing but attracting forces. They both contribute to lowering the interaction costs between people, i.e. the time, energy and money spent to connecting people and facilitating transactions. Digital technologies make it increasingly easier to communicate instantly and over large distances. Cities lower transport costs by bringing people closer together geographically.[15] These two factors appear to be, on average, complements rather that substitutes for each other. For instance, digital and mobile communications contribute to making it easier for people to connect and meet up to go to the opera in a large city, but if one of them was in Tallinn and the other in Copenhagen their interaction would be limited and they would not be able to enjoy the opera together.

Productive exchanges between firms and individuals rely on different types of interactions that are facilitated both by digital connectedness and physical proximity, where one cannot substitute the other. Duranton and Puga use the term "Nursery city" to conceptualize a relocation pattern in which innovating firms locate themselves inside large cities in order to benefit from proximity and knowledge spill overs.[16] When a firm moves from innovating to producing according to a fixed process, it relocates to outside the city to lower its costs. Put differently, a firm can choose to pay a higher land rent because it helps their innovation process. This description appears to be strongly consistent with the growing of digital start-ups in dense inner city areas, with the important exception that their production doesn't necessarily require that much floor space and so they seem to stay in the central neighbourhoods. Twitter, Uber and Airbnb for example have chosen to locate in downtown San Francisco.

Keeping in mind that cities in North America have exhibited more urban sprawl than European cities historically, recent research on the subject suggest that central neighbourhoods in Canadian cities are going through a shift from production to technology-driven start-ups.[17] This shift may be caused by several factors including changes in workforce lifestyle preferences, a growing focus on digital content services which implies an overlap between creative and innovative activities, a miniaturisation of hardware which lowers the demand for floor space, and new availability of commercial space in central areas as old factory neighbourhoods are being revitalized. It is a match between proximity and connectivity. These types of firms are arguably among the most digitally connected there are, and yet they value physical proximity enough to pay considerably for it, especially in cities like the Swedish capital Stockholm where land rents are skyrocketing. Hence, cities evidently play a role in the future of digitisation.

[11] http://www.economist.com/node/9070726
[12] Varian (2010)
[13] Ibid, p. 5
[14] Top of Digital Europe (2014)
[15] Glaeser and Kohlhase (2004)
[16] Duranton and Puga (2001)
[17] Duvivier and Polèse (2016)

Conversely, digitisation is forming a layer of data over the city, or a "digital skin".[18] Public transit timetables and traffic flows, smartphone applications with map layers, and customer ratings and recommendations of restaurants, bars and tourist attractions are just a few examples of how public administration, firms and individuals contribute to generating huge amounts of data. These data could in turn be facilitated in open data initiatives and data-driven development and innovation.[19] The Senseable City Lab at MIT, USA, has conducted an impressive and inspiring collection of data-driven experiments in cities including analysing taxi traffic, tracking waste and visualizing tourism through pictures posted to the photo sharing platform Flickr.[20] This, together with the digitisation of public administration, provides fertile soil for smart city initiatives, civic hacking and urban innovation.[21]

In a similar manner, connectivity and the opportunity to access information anywhere and at any time is likely to change cities as we know them in several ways. According to the Ericsson Networked Society City Index, ICTs bring about a global scale of participation in cities, enable new forms of production and consumption, and provide an open and collaborative environment.[22] For example, a growing number of people are found working in coffee shops, or at home. Using laptops, tablets or even their phones they can access the same information as in their offices, meaning they can work in between meetings or even spend entire days out of office to be able to focus on a particular task. In San Francisco there is a strong connection and a long history between coffee shops and tech start-ups.[23] This is an important example of how digitisation and urbanisation is interacting. Office buildings are not likely to disappear altogether, but coffee shops and other similar places are likely to become increasingly important for productive exchanges and innovative ideas in the future.

Together, digitisation and urbanisation give rise to a particular market of its own: Urban digital markets.[24] These are markets that rely on highly localised demand and supply, together with instant connectedness and matchmaking through digital networks. A prime example of this would be ride-hailing apps like Uber. Both driver and rider have to be in the same city, and they rely on a digital matchmaking platform to make sure that a driver that is available is connected to a rider who needs a ride right now. This provokes the way we think about transport in cities, but it should also provoke the way we think about the digital market. A lot of rising digital start-ups, especially within the so called sharing economy, actually rely heavily on local markets for their business model. A relevant aspect of urban digital markets is that when these businesses internationalise, they do not move into a new country. Instead, they move into a new city. That is, an international urban digital market is a network of dense, connected cities.

3.2 URBAN GROWTH ENGINES

Density matters. According to the World Bank, more than 80 percent of the world's GDP comes from cities.[25] According to the UN's World Cities Report 2016, the top 600 cities globally account for 1/5 of the world's population and produce 60 percent of global GDP.[26] Looking at the Baltic Sea Region, Sweden is reported to be one of the fastest urbanising countries in Europe.[27] According to Eurostat, Riga and Tallinn house over 30 percent of their countries' populations respectively, while Helsinki and Vilnius house around 20 percent of the Finnish and Lithuanian populations. Also, even though Warsaw only houses approximately 5 percent of the Polish population, it is still a city of over 1.7 million people. Data from OECD show the rising GDP produced in cities **(Fig. 10a)**.[28] Note that the capital cities are rising significantly, except for Tallinn which is on the level of Lódz and Malmö. A closer look at GDP per capita in the OECD data gives an illustration of the concentrated urban growth **(Fig. 10b)**. It also shows that for instance Oslo has a significantly higher GDP per capita than Warsaw, while the latter generates more GDP in total. Despite a significant fall after the economic downturn in 2007-2008, Tallinn shows strong signs of growth. Stockholm is overall high both in absolute terms and in GDP per capita.

FIG. **10 A**

GDP from cities

(OECD)

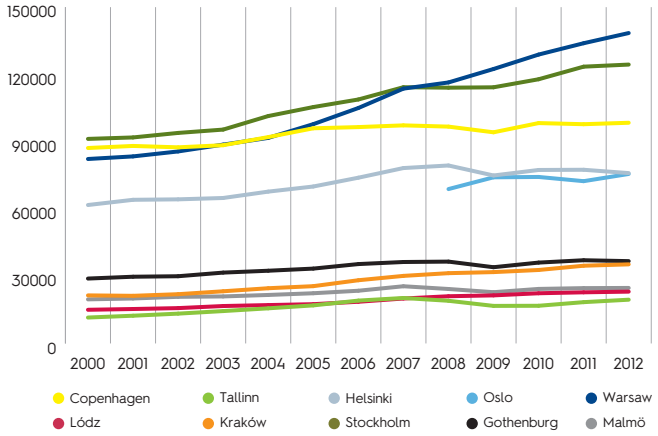
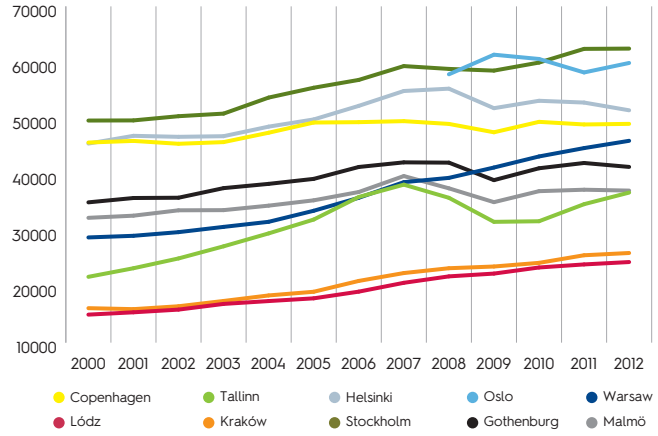


FIG. **10 B**

City GDP per capita

(OECD)



[18] Rabari and Storper (2015)
[19] Top of Digital Europe (2016)
[20] Offenhuber and Ratti (2014)
[21] Townsend (2013)
[22] https://www.ericsson.com/assets/local/networked-society/reports/city-index/2016-networked-society-city-index.pdf
[23] http://www.theatlantic.com/technology/archive/2011/02/lets-just-make-the-startup-coffee-shop-thing-official/71603/
[24] Wernberg and Dexe (2016)
[25] http://www.worldbank.org/en/topic/urbandevelopment/overview
[26] http://unhabitat.org/un-habitat-launches-the-world-cities-report-2016/
[27] https://www.thelocal.se/20120408/40152
[28] Unfortunately, Lithuania and Latvia are not included in the OECD data.

Urban growth is commonly associated with so called agglomeration economies. These are described as economies of scale that are external to firms but locally bound. Put differently, there are productivity benefits associated to being located in close proximity to others. Agglomeration effects include both positive contributions such as higher innovation and entrepreneurship frequencies, and negative contributions such as congestion or increased crime rates. One of the main challenges for city leaders is to promote the positive agglomeration effects while preventing the negative effects.

In the research literature, agglomeration economies are often assumed, theoretically, to be driven by micro-foundations, such as sharing of transport infrastructure, improved matching in thick labour markets and learning through knowledge spill overs.[29] Perhaps most elusive of these, but also most interesting, is learning and knowledge spill overs. Cities are essentially co-located social networks, or even social accelerators that facilitate interactions between people. These interactions act as vehicles for knowledge and information flows - both directly between individuals and indirectly through behaviour and attitudes influenced for instance by inspiration, competition or imitation.

Learning and knowledge spill overs have been investigated empirically in a wide variety of ways, for instance by comparing cities with specialised industrial composition to those with a more diverse industrial structure.[30] Another contribution to this research introduces different forms of diversity - related and unrelated diversity - to explain why some types of diversity between firms may spur innovation while others may not.[31] Put differently, based on how different industries have interacted historically, for instance by mapping how people switch jobs, it is possible to map how close the bonds are between different sectors and, based on this, predict the potential for future interactions.

Another line of recent research along this vein suggests two important things about knowledge-related agglomeration effects inside cities: First, that agglomeration effects vary in their spatial distribution and attenuation, and the evidence are consistent with the notion that knowledge spill overs are very localized even within cities.[32] Second, effects of industrial specialisation and diversity may co-occur in cities but on different spatial scales. Highly specialised neighbourhoods, such as a shopping district or a banking neighbourhood, may generate localized agglomeration effects, while a diversified city-wide industrial composition can contribute to cross-sectoral innovative and productive exchanges.[33] In both cases, effects appear to be particularly important for small firms and knowledge-intensive activities. This relates back to the connection between tech start-ups and coffee shops in San Francisco and elsewhere. In a famous comparison between the two innovation clusters Silicon Valley and Route 128, Annalee Saxenian emphasised the need for a culture of openness across organisational borders and between firms in bringing Silicon Valley to the global front.[34]

These research findings are mirrored by a growing number of policy-oriented initiatives such as start-up ecosystems and innovation districts.[35] As cities grow in size and complexity, policymakers will need an improved toolbox for intra-city level policies. It is, however, important to underline that it is unclear to what degree policy can direct localized agglomerations. More important in this context is to address issues that restrict firms, entrepreneurs, universities and venture capitalists from self-organising bottom-up within their cities. It may just be that a few successful coffee shops are just as important to urban growth and innovation, or more so, than detailed top-down policy in the future. Vibrant inner city districts embody both social networks, the flow and exchange of ideas and the experimental innovation that technology-driven start-ups bring about.

In summary, cities attract and house growing concentrations of highly educated people. This, together with a vibrant local buzz, provides fertile ground for innovation- and tech-driven start-ups. They are small and knowledge-intensive, which means that they are likely to benefit from local knowledge spill overs with other start-ups as well as with large firms and other actors.

Recent research on so-called Entrepreneurship Ecosystems[36] as well as Entrepreneurial Systems of Innovation[37] argues that small and large firms interact in several important ways. For example, large firms often breed new entrepreneurs, as employees in large firms acquire advanced business knowledge. Second, small firms also need to hire people with specialized skills, which are more likely to be found in a large city's thick labor market and in cities hosting large knowledge intensive firms that help to pull in human capital from the outside. Third, small and large firms complement each other. Small technology-based new firms often have a comparative advantage in developing radical technologies and innovation, but lack capital and resources to scale up their novelties, for example in terms of introducing them to world markets and embedding them in existing systems. Large firms, on the other hand, may lack the creativity and ingenuity of small innovative firms, but they have the complementary resources to refine and scale-up innovations. This complementarity between small and large firms in the innovation process has been dubbed the "David Goliath symbiosis"[38].

In summary, cities provide agglomeration effects that are external to firms but internal to the local economy. This makes them important arenas for productive exchange, especially for small firms and knowledge intensive activities, such as tech-driven start-ups. They benefit from interactions both with other start-ups and with larger companies. Research also shows that there is a scope for particularly productive areas within cities. This is mirrored by a recent rise in policy aimed at developing and supporting innovation districts or start up ecosystems within cities.

3.3 NETWORKING CITIES

Urbanisation and digitisation are intertwined. Both trends contribute to lowering the cost of interaction between people, but they seem to complement rather than substitute each other. That is, the development of digital communication technologies has not swayed people or firms from locating in dense cities despite rising costs. This could partly be explained by the notion that they affect different types of interactions differently, in particular with respect to the flow of ideas and information between people and firms. Digital communication makes it possible to maintain personal contacts over long distances with low effort, whereas

[29] Duranton and Puga 2004
[30] Feldman and Audretsch 1999; Glaeser et al 1992
[31] Frenken et al 2007
[32] Andersson et al 2016, Andersson and Larsson 2016
[33] Andersson et al 2016b
[34] Saxenian 1996
[35] Feld 2012; Katz and Wagner 2014
[36] Mason and Brown 2014
[37] Lindholm, Andersson and Carlsson 2016, Andersson and Xiao 2016
[38] Baumol 2002

the proximity in cities makes it a lot easier to meet new people and make new acquaintances.[39]

That is, the comparative advantage of digitisation appears to be the facilitation of established long-distance contacts, while urbanisation facilitates local interactions with both established and new relationships.

In terms of knowledge creation in firms, this duality in interactions has been conceptualized as "global pipelines and local buzz".[40] Local buzz is the face-to-face interactions between people in a city that contributes to things like communicating tacit knowledge, building trust, creating incentives and aligning commitments[41] Also, local buzz can be largely unstructured, spontaneous, frequent and effortless. For instance, one empirical study finds evidence of local productivity benefits consistent with knowledge spill overs for advertising firms on Madison Avenue in New York City, but these benefits dissipated quickly with distance and vanished outside a perimeter of roughly 750 meters.[42] In comparison, global pipelines are long-distance interactions between experts to exchange detailed and tacit knowledge. These interactions require more structure and planning, making them costlier and niched.

Consequently, local buzz can be thought of as densely but loosely connected local social networks, whereas global pipelines form so called weak ties between different local networks.[43] Weak ties here refers to their bridging function between parts of a network that would otherwise be disconnected. Also along this vein, Annalee Saxenian has studied how foreign-born, skilled individuals return to their home countries after gaining experience in Silicon Valley to become cross-regional entrepreneurs.[44] She refers to this group as the "new argonauts", and argues that they provide an essential mix of local knowledge and global connections.

This means that firms with successful pipelines contribute not only to the local buzz within their own organisation, but also to some degree to the local interactions between firms. In fact, in the original study where the concept pair was introduced the authors argue that some types of local policy ambitions may be somewhat misdirected. Instead of trying to encourage local buzz between firms (it will occur anyway), policy measures could be used to promote global pipelines.[45] Indeed, the best local policy may be to promote global connections and to a larger degree let local buzz organise itself. Imagine a local cluster of tech start-ups adjacent to a coffee shop and a university, an innovation district of sorts, where each firm brings its own global pipeline to the local buzz. Science parks could provide a vital infrastructure to combine global pipelines across borders with being connected to the local buzz of their cities, for instance as part of the International Association of Science Parks (IASP) which includes member cities from each country in the region.[46]

With the ongoing urbanisation and the concentration of economic growth to the cities, there is a need for a decisive shift in government and policymaking towards the regional level. With growing differences between rural and urban areas, as well as between different cities, national policy initiatives risk being too blunt to cater to regional needs, for instance in terms of industrial policy. Bruce Katz and Jennifer Bradley, authors of the book The Metropolitan Revolution, argue that following the great recession, many American cities were left to their own devices and that much of the needed reshaping is being done by networks of city leaders[47] The authors use as an example the New York City Applied Sciences Initiative.[48] Following the economic downturn in 2008, a lack of technological and engineering skills was identified as a significant weakness in the local economy. To address this issue, a competition was initiated in 2010 to attract a new graduate campus to move or to expand to the city. The winner would get a city-owned site for the campus and a USD 100 million investment in infrastructure and related improvements to build the campus. Because of the positive response, the initiative had led to three new campuses by 2012, rather than just one.

In summary, cities constitute an increasingly important level of governance for promoting economic growth and development. They combine local, spontaneous interactions between people and firms (local buzz) with more structured global interactions (global pipelines). Promoting these two types of interactions requires different policy approaches. Local buzz is more likely to grow organically, while global pipelines could benefit from more supportive policy measures.

3.4 CITY NETWORKS IN THE BALTIC SEA REGION TO CONNECT DIGITAL MARKETS

Cities in the Baltic Sea Region have a lot to gain by stepping up and collaborating, not only within but also across national borders.[49] Compared to the U.S., there are bigger differences between European countries, for instance when it comes to language, culture and business climate. This marks a significant obstacle to advancing a single digital market and building trust across national borders. Cities with strong digital and technology-driven economies provide a vital link in bridging this gap.

Cities constitute hubs in the physical economy by providing proximity and lowering transport costs. They also form hubs in the digital economy by generating large amounts of data, concentrating tech-driven innovation and linking physical and digital connectedness. This makes them excellent nodes in a macro-regional cross-border networks.

Historically, cities have played key roles in promoting trade across the Baltic Sea. The Hanseatic League, a confederation formed during the late middle ages by merchant guilds and cities, were dominant in maritime trade between the 11th and16th century.[51] Although trade agreements have come a long way since then, the idea that cities could be the standard bearers of such collaborations may be more important today than ever before. Competitive advantage can arise from reciprocal cooperation between so called network cities, linked by corridors of transport and communication infrastructure.44 Cities can, the author argued, exploit complementary advantages and joint synergies in much the same ways as inter-firm networks can. He pointed to the Swedish cities Stockholm and Uppsala as an example. The same argument could be made for Copenhagen in Denmark and Malmö in Sweden, or even Copenhagen-Malmö-Lund. Similar networks could also be established between more distant cities, provided that there are fast corridors of transport and communication infrastructure and well-functioning institutions for cooperation both at the market-level and in public administration.

There are a significant number of networks and institutionalised collaborations between cities in the Baltic Sea region.

[39] There is of course an overlap. People do meet new friends from other places online, and research suggests that it is still easier to maintain relations with people living close by than far away. Urban digital markets, as mentioned in 3.1, is an excellent example of how these overlaps interact and reinforce each other.
[40] Bathelt et al 2004
[41] Storper and Venables 2003
[42] Arzaghi and Henderson 2008
[43] Granovetter 1973
[44] Saxenian 2007
[45] Bathelt et al 2004 p 26-27
[46] http://www.iasp.ws/by-country
[47] Katz and Bradley 2013
[48] http://www.nycedc.com/project/applied-sciences-nyc
[49] Lundblad 2015
[50] https://en.wikipedia.org/wiki/Hanseatic_League
[51] Batten 1995

Some of these are cooperation between individual cities, whereas others are organisations of their own where cities are members. The former may in many cases be stronger, but they are considerably harder to quantify and map exhaustively. The latter vary in scope and activity, but they still provide a traceable indication of the institutional experience and conditions for networking between cities in the region.

We have collected a sample of 20 cross-border city network organisations and mapped the ties between the three largest cities in each country. The results show that most of the cities are interconnected and are part of several different networks **(Fig.11)**.[52] The capital cities have the highest number of network memberships, with Riga in the very lead. Malmö sticks out as an intense networker by being member of more organisations than both Gothenburg and Stockholm in Sweden. Plotting how each capital is connected to the three largest cities in each country provides an illustrative overview of the institutional interconnectedness **(Fig. 12)**. To provide more detail on how cities are connected to each other we computed a connectivity matrix **(Fig. 13)**. This provides some indication of how developed the respective collaborations are. Blue cells indicate 1-3 shared networks while orange corresponds to 4-6 shared memberships and red cells mark high overlaps of 7-9 memberships.

However, most of these networks primarily engage policymakers and public servants in each country. This is only half of the story, and most if not all of the potential in macro-regional city networks lies in connecting market actors with each other and new customers across borders, just as trade was at the heart of the Hanseatic league. These mapped networks provide a strong institutional basis for moving further and establishing partnership agreements and collaborations between urban markets aimed at establishing global pipelines between firms and individuals.

FIG. **11**

The number of network memberships per city, based on a sample of 20 network organisations

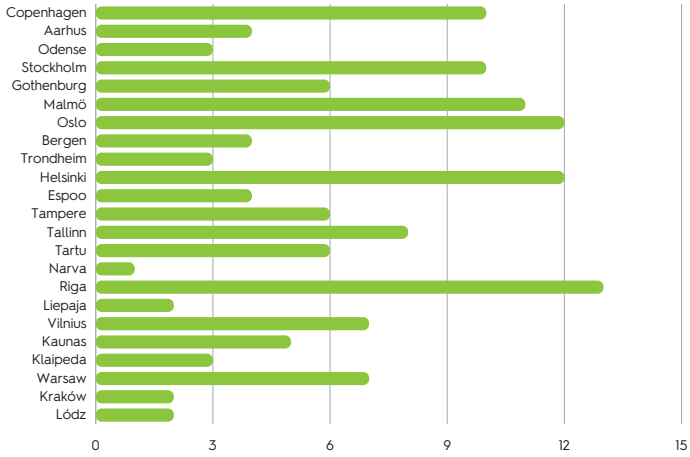
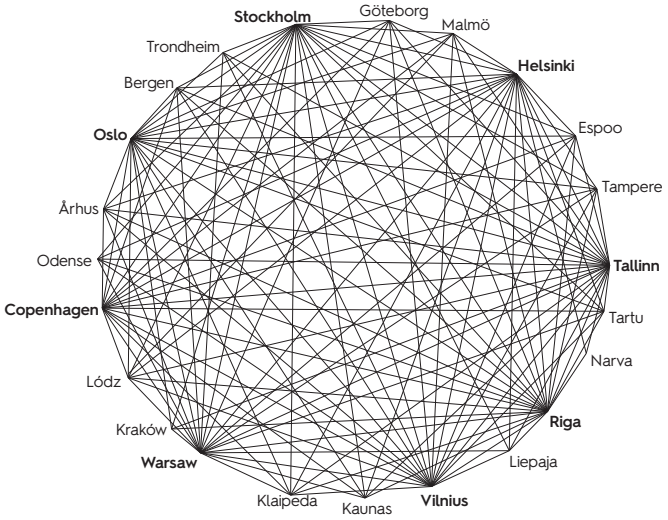


FIG. **12**

A network graph showing the links from capital cities to other cities in the region. Links between any two non-capital cities have been removed for clarity.



A connectivity matrix mapping the mutual network memberships between any two cities. The matrix is based on a sample of 20 network organisations that are active in the region. Combining a row city (to the right) and a column city shows how many network memberships they share. For instance, Copenhagen and Malmö share five networks.

FIG. **13**

	Copenhagen	Stockholm	Oslo	Helsinki	Tallinn	Riga	Vilnius	Warsaw	Tartu	Kaunas	Århus	Klaipeda	Lódz	Tampere	Espoo	Göteborg	Malmö	Bergen	Odense	Liepaja	Trondheim	Kraków	Narva
Copenhagen		6	7	7	4	5	4	5	2	1	2	1	1	2	2	3	5	2					
Stockholm	82		9	7	5	6	5	8	4	2	3	2	2	3	3	5	5	3	1	1	1	1	
Oslo	83	74		7	4	7	4	6	3	2	3	1	1	3	2	5	8	2			1	1	
Helsinki	74	70	81		5	9	4	4	4	3	3	2	1	4	3	2	7	3	1	1			1
Tallinn	70	81	70	56		7	6	5	3	3	3	3	2	3	3	3	3	3	1	2	2	1	1
Riga	81	70	56	53	48		6	4	4	4	3	2	1	4	2	3	7	2	1	1	1	1	1
Vilnius	70	56	53	48	55	40		4	1	1	1	2	2	1	2	3	2	2	1	1	1		
Warsaw	56	53	48	55	40	35	46		3	2	2	2	2	3	3	4	3	3	1	1	2	1	
Tartu	53	48	55	40	35	46	54	68		3	2	2	1	3	3	3	3	3	1	2	2	1	1
Kaunas	48	55	40	35	46	54	68	75	51		3	3	2	4	3	3	4	3	2	2	2	1	1
Århus	55	40	35	46	54	68	75	51	21	25		2	1	3	2	2	4	2		1	1	1	1
Klaipeda	40	35	46	54	68	75	51	21	25	26	12		2	2	3	2	2	3	1	2	1		1
Lódz	35	46	54	68	75	51	21	25	26	12	12	12		1	2	2	1	2	1	1	1		
Tampere	46	54	68	75	51	21	25	26	12	12	12	12	12		3	3	5	3	2	1	2	1	1
Espoo	54	68	75	51	21	25	26	12	12	12	12	12	12	12		3	3	4	1	2	1		1
Göteborg	68	75	51	21	25	26	12	12	12	12	12	12	12	12	12		5	3	1	1	2	1	
Malmö	75	51	21	25	26	12	12	12	12	12	12	12	12	12	12	12		3	1	1	1	1	1
Bergen	51	21	25	26	12	12	12	12	12	12	12	12	12	12	12	12	12		1	2	1		1
Odense	21	25	26	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12		1	2		
Liepaja	25	26	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12		1		1
Trondheim	26	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12		1	
Kraków	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12		
Narva	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	

[49] This is by no means an exhaustive list and it excludes isolated sister city agreements. Rather, this is a list of large city networks focused on the Baltic Sea region and its macro-regional development in a range of areas. Connections between any two non-capital cities have been removed for clarity. A complete list of the networks is found in Appendix 2.

In 2013, Chicago and Mexico City entered into what was reportedly the first city-to-city partnership agreement of its kind.[53] The agreement includes joint initiatives in areas such as education, trade and innovation to foster greater global competitiveness together. Similarly, key cities in the Baltic Sea Region could form a Digital Hansa to promote innovation, entrepreneurship and growth through the flow of information, ideas and human capital between urban economies. Cities provide gateways to connect regions to the global economy, but they conversely also provide gateways for the world into the region.[54] By making it easier for individuals to access education and job markets in other cities, the entire city network would effectively acquire a larger supply and demand of digital skills. Easier access to cities in other countries and their markets could also provide valuable early market experience, opportunities to learn from each other and access to testbed environments for start-ups and innovators. Networks between cities would not only connect their respective markets of local buzz, but also promote global pipelines between them, and to the rest of the world.

In many large cities and metropolitan regions like New York, Boston, Paris, London, Shanghai, San Francisco and Berlin, global pipelines emerge spontaneously. The reason is that such cities host significant resources, like firms and experts considered as attractive collaboration partners worldwide and an inner city economy that attract firms as well as experts from all over the globe. Therefore, global pipelines and other forms of network constellations to other parts of the world form easily, as the rest of the world seek to be connected to the world's main cities.

Together, the BSR cities have many of the components of what would be a formidable tech cluster, but their challenge lies in connecting across borders and the Baltic Sea. Furthermore, the cities in this region lack the size and stature of the major metropolitan regions the world economy, which means that pipelines and network constellations are likely to require effort and purposeful strategy. The gains from such pipelines and networks are not lower in Baltic Sea Region, they simply require more work.

City networks and pipelines can function as a substitute for the, in an international comparison, relatively small size of the cities in the region. That is, by being connected to each other, these cities become more attractive to cities outside the network. Cities like Stockholm, Copenhagen and Tallinn have unique start up environments that draw global attention. Together, they would not only benefit from each other, but also form a more complete competitive global start up scene. For instance, Stockholm is reported to be the start up capital of Europe and a unicorn factory.[55]

There is a general lack of detailed data on start-ups at the city level in the BSR, which may be a bit surprising given that there are a lot of rankings of cities' start up ecosystems. However, this data is often opaque and hard to interpret beyond the ranking order. Available data on the level of countries are likely to reflect at least some the start-up activity in their major cities. **Fig. 14** shows births and deaths in Computer and programming as well as ICT as fractions of the business stock. The numbers suggest that there is significant start up dynamics in both sectors, and that the fraction of births is greater than the fraction of deaths in most of the countries. This means that most countries in the BSR experience positive net entry rates in both industries. It also suggests good conditions for synergy effects from stronger networks between cities in the BSR. Poland appears to be gaining some momentum in start up activities in Warsaw and Krakow, which would be in line with their high numbers, in absolute terms, of digitally skilled people compared to the other countries in the region **(Fig. 15)**.[56]

FIG. **14 A**

The share of births and deaths compared to the total stock of firms in computer programming and consultancy 2013

Data on firm deaths is not available for Poland

(EUROSTAT)

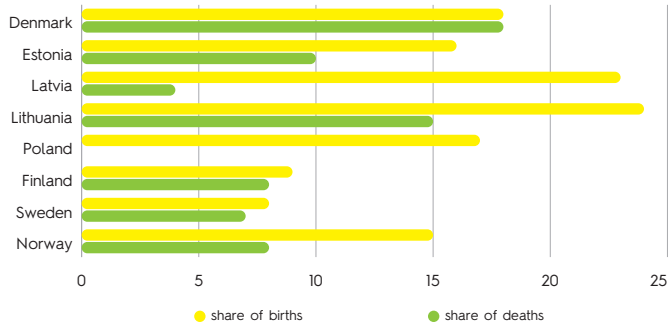


FIG. **14 B**

The share of births and deaths compared to the total stock of firms in ICT 2013

(EUROSTAT)

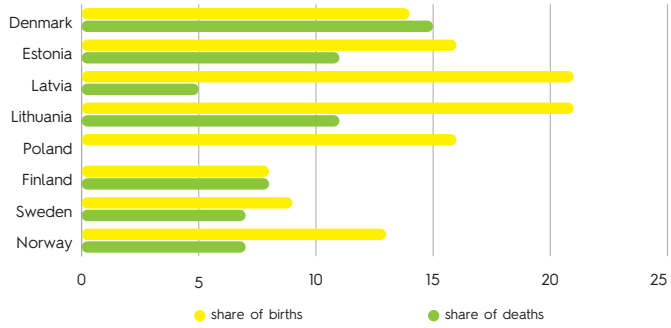
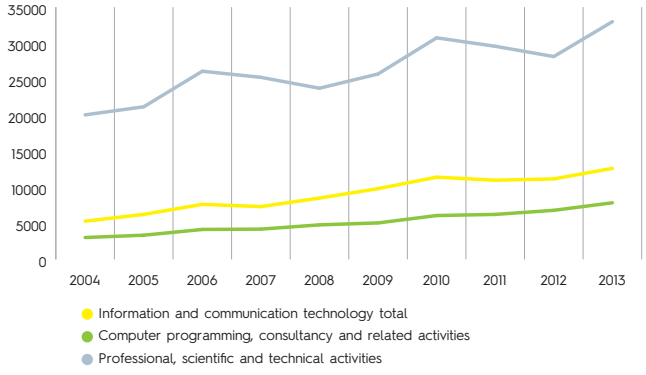


FIG. **15**

New firm entries per sector in Poland 2004-2013

(EUROSTAT)



[53] https://www.brookings.edu/blog/the-avenue/2013/11/18/chicago-and-mexico-city-cut-new-kind-of-trade-deal/
[54] Andersson and Andersson (2000)
[55] https://www.ft.com/content/e3c15066-cd77-11e4-9144-00144feab7de
http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/11689464/How-Sweden-became-the-startup-capital-of-Europe.html
[56] http://www.forbes.com/sites/alisoncoleman/2016/05/20/poland-on-track-to-becoming-a-major-european-tech-startup-hub/#f0d1038431bc
http://www.forbes.com/sites/alisoncoleman/2015/12/16/four-european-tech-hubs-that-are-hot-on-berlins-heels/2/#3777b44c33e5

According to Startup Heatmap Europe 2016, based on a survey among start up founders, seven BSR cities rank on the top 30 list for start-up hubs: Stockholm (7), Copenhagen (9), Tallinn (12), Warsaw (15), Helsinki (20), Riga (22), Oslo (23).[57] That is two cities in the top ten list. This ranking is particularly interesting since it gives the founder's current perspective on the region.[58]

In building and promoting macro-regional networks, cities also have the advantage of familiarity. Large cities are more likely to resemble each other across borders than their respective nations generally are. Apart from physical similarities, most large cities gather enough people, firms and visitors to support a supply of internationalised goods and services which, although there are local differences, look fairly similar across borders. This is further expanded in urban digital markets, which rely on density and connectedness to support highly localized supply and demand in a global network of places. Similarities in digital services and interfaces promote trust. Consider for instance the issue of getting a taxi from the airport to the hotel in a new city. The first thing most travellers would do is to try to determine what cab service to use - is there a risk of being scammed, will prices differ significantly, is payment by credit card available, and can they all be trusted? On the other hand, if the traveller can use the same app interface as back home to get a ride in the new city, this instantly transfers some sense of trust to the new place.

4 POLICY RECOMMENDATIONS

4.1 FRAMING POLICIES FOR BUZZ AND PIPELINES

In the 2015 Digital State of the Region report, we introduced the idea that macro-regional collaboration can act as a complement to both national and EU-wide initiatives to establish a digital single market. This idea also lies at the heart of this report's focus on cities and city-to-city networks. Just as BSR can become a forerunner in advancing a digital single market, so could the BSR cities be forerunners in establishing cross-border collaborations within the region. Cities are social and economic arenas for productive exchanges in their regions and nations, but they also provide gateways to a globally interconnected economy and a first point of contact for many if not most of those connecting to the region from other parts of the world.

In order to leverage the potential of cross-border city-to-city networks fully, policy needs to be two-pronged. Policy must be directed towards the development within each city as well as towards connections between cities. This corresponds to the pair of concepts presented in 3.3, local buzz and global pipelines. Local buzz is characterised by largely unstructured interactions between individuals and organizations which foster flows of information and ideas. Although a lot of cluster policy has been aimed at promoting these kinds of dynamics locally, there is a clear limit as to how far they can be commanded by top-down interventions.

On the other hand, policy can play a key role in enabling people, firms and their resulting interactions to self-organise within the city. Such policies include, but are not restricted to, initiatives aimed at urban planning, like making it easier for start-ups and firms to locate and co-locate in cities, promoting a variety of amenities such as coffee shops, bars and restaurants that can act as focal points of social interactions, and making interactions with local institutions and authorities as easy as possible.

With respect to digitisation and the digital market, local buzz policies should focus on providing adaptable and experimental policy frameworks. Rather than engaging in conflicts and banning new services like Uber or Airbnb, city leaders could invite entrepreneurs to conduct controlled experiments together with the city. For example, in Pittsburg a fleet of autonomous Uber cars took to the streets in the fall of 2016.[59] This provides an important testbed environment for Uber, but it also creates a tremendous earning opportunity for policy makers, urban planners and local entrepreneurs. It should also be noted that the autonomous cars are produced by Volvo in Sweden, implying that there is definitely a scope for similar experiments in the BSR. An important point in this regard is that this perspective potentially turns a relatively small size into a strength.

BSR cities' relatively small sizes, compared to major cities like Shanghai or New York City, together with their technological maturity play to their strengths in this regard. It is much easier to conduct controlled experiments in a city like Tallinn or Malmö than in London. City leaders could also promote vibrant local tech-driven start up communities by providing quality open government data or adapting the procurement process to invite small firms and entrepreneurs with innovative solutions.

In contrast, global pipelines are much harder to establish and maintain, especially for small firms and start-ups. Even though they are digitally connected, this does not necessarily translate into new expert contacts, local market knowledge or lower thresholds to actually moving between cities. As seen in section 3.3, policy makers in most BSR cities already share institutional networks with most other large cities in the region. However, these networks tend to focus on connecting policy makers, not market actors. Yet, city leaders could leverage their institutional ties to other cities in order to promote new networks between small and medium-sized firms across borders.

This calls for a more direct and supporting policy approach. For instance, city leaders could use institutions like science parks to connect places between cities to host visiting start-ups and integrate them in local networks. An excellent example is provided by the TechLink initiative, which is organised by UK Trade & Investment to connect people, teams and projects between Estonia and the UK on specific technology issues, showcase early-stage R&D projects to promote cross-border collaboration, and to create a joint channel for information sharing between stakeholders in each country.[60] UK Trade & Investment is also a partner of the Tehnopol Science Park in Tallinn, where visitors can find a "Union-jacked" room called the UK Lounge.

[57] http://www.startupheatmap.eu/

[58] In the European Digital City Index (EDCI) Stockholm (3), Helsinki (4) and Copenhagen (5) are ranked top five in a list of 35 cities, while Tallinn (20), Warsaw (24) and Vilnius (29) are in the 20's of the same list and Riga (32) comes in last in the region at 32nd place (see https://digitalcityindex.eu/). Such rankings, however, should be interpreted with some care since they are hard to put into context. For instance, data is collected and compared at different spatial units of analysis (NUTS2 level is significantly larger than cities), data is weighted based on expert interviews, and the output is aggregated into a dimensionless score and a resulting ranking. That is, there is a need for more detailed city-level data on issues like digitisation and tech-driven startups in order to move beyond mere comparisons and identify local excellence and barriers.

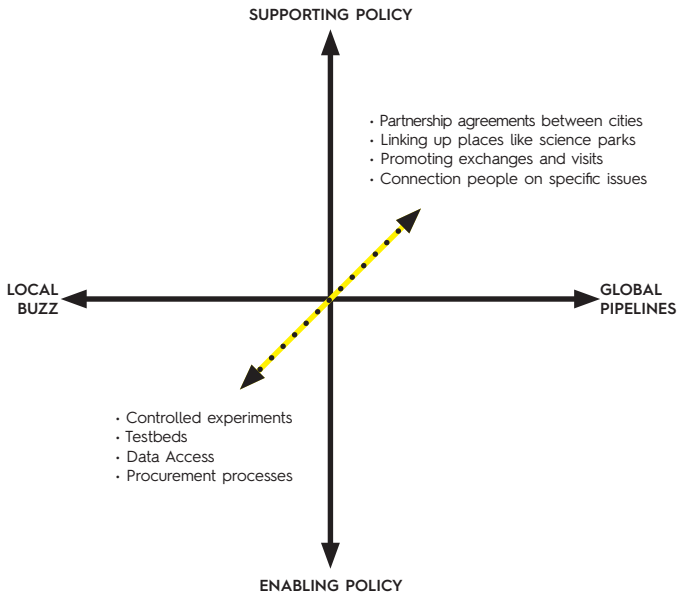
[59] http://www.bloomberg.com/news/features/2016-08-18/uber-s-first-self-driving-fleet-arrives-in-pittsburgh-this-month-is06r7on

[60] http://ukesttechlink.com/about-us/

We propose a scope of policy that ranges between enabling policies to grow local buzz within cities and central neighbourhoods, and supporting policies to create global pipelines to connect BSR cities to each other and to other global cities around the world **(Fig. 16)**.

FIG. **16**

The graph illustrates the scope of policy measures ranging between enabling policies to achieve local buzz to supporting policies to achieve global pipelines



4.2 POLICY PROPOSALS

In this section, we present two sets of policy proposals, broadly categorized into local buzz policies and global pipeline policies. The buzz proposals focus on controlled experiments, while the pipeline proposals focus on city-to-city partnership agreements.

Local Buzz: Conducting Controlled Experiments

BSR city leaders should conduct controlled experiments together with academic researchers and tech-driven start-ups. The experiments should focus on the interplay between digitisation, new technologies and the city. City leaders play a key role in enabling experiments in their own cities, lobbying towards national governments to adapt regulations to new technologies, showcase outcomes of successful city policy experiments to national governments, and to network with other city leaders to learn from each other and exchange best practises. This would turn cities into forerunners and potentially bode for bottom-up policy from the level of cities to the level of national governments. Policy proposals could include, but should not be limited to:

- If there isn't already one, hire a Chief Data Officer in the Mayor's office. This person should not only work to bring data-driven policy tools into the city governance structure, but also function as a liaison to the start-up community as well as to the academic research community. This person should also be in charge of encouraging and implementing controlled experiments and experimental policy measures.

- Engage start-ups and academic researchers to identify key areas for experimentation.

- Create testbed environments for the experiments and, if possible, invite a wide variety of actors to participate. Relevant testbeds will have the potential to attract entrepreneurs and innovators from outside the city region, which also promotes global pipelines.

- Evaluate all experiments and integrate them into the city policymaking process.

- Adapt procurement processes, for instance by using e-procurement, to attract small firms and tech-driven start-ups.

- Provide access to high-quality open government data sets and engage with the developer community to identify desired data sets, issues or opportunities. Arrange innovation competitions to engage developers and entrepreneurs with the city's challenges by providing relevant data resources and a tangible problem to solve.

Global Pipelines: Partnership Agreements Between Cities

BSR city leaders should make it a core purpose of their institutional framework to promote and support networks between tech-driven start-ups, innovators and entrepreneurs in different cities. They should do so by entering into a BSR city partnership agreement aimed at building pipeline networks between urban economies. There is a wide variety of network collaborations between the larger cities in the region. These provide an institutional structure to facilitate exchanges between start up scenes in different cities. In doing so, policy makers contribute to connecting local entrepreneurs to new talent, markets, inspiration and collaborations in other cities. Conversely, they also invite entrepreneurs from other cities to connect to their city, bringing in new knowledge, experience and ideas. Policy proposals could include, but should not be limited to:

- Establish an exchange program for tech-driven start-ups between BSR cities. Turn the city's science park or incubator into a landing platform for incoming start-ups and connect these science parks to each other in a BSR start up-swapping network. That way, incoming visitors are integrated into the local network, and local start-ups are given the opportunity to go to other cities to establish new networks there.

- Identify underutilised city-owned office space and use it to offer temporary offices to visiting start-ups. Ideally, visiting start-ups within the exchange program should get access to free office space and housing for a restricted period ranging between one week and one month. Conversely, local start-ups would get the same opportunity in other cities.

- Utilise e-procurement to reach and attract innovators and small firms in other cities and countries. Conversely, local start-ups and entrepreneurs will be able to participate in procurements in other BSR cities.

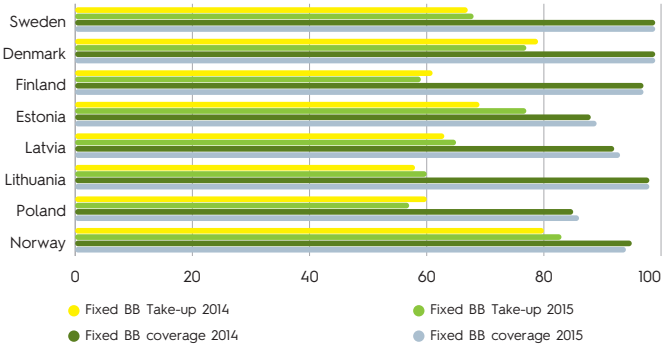
APPENDIX 1: UPDATED GRAPHS AND FIGURES

This section includes a set of updated graphs and figures corresponding to the ones presented in the State of the Digital Region 2015.

APP. **1**

Fixed Broadband Coverage and Up-take (% Households) 2014 and 2015

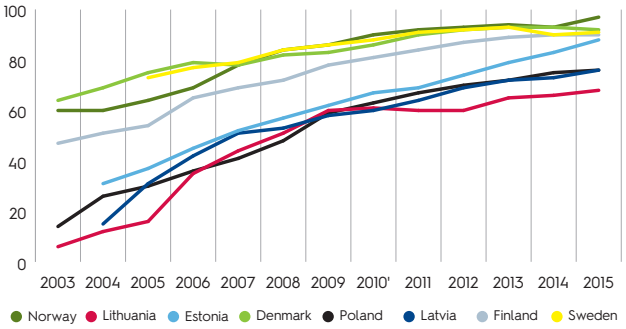
(DIGITAL AGENDA SCOREBOARD)



APP. **2**

Households with Internet Access at Home (%) 2003-2015

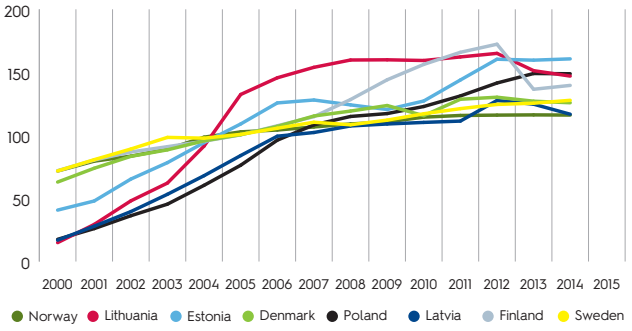
(DIGITAL AGENDA SCOREBOARD)



APP. **3**

Mobile Phone Subscriptions/100 people 2000-2014

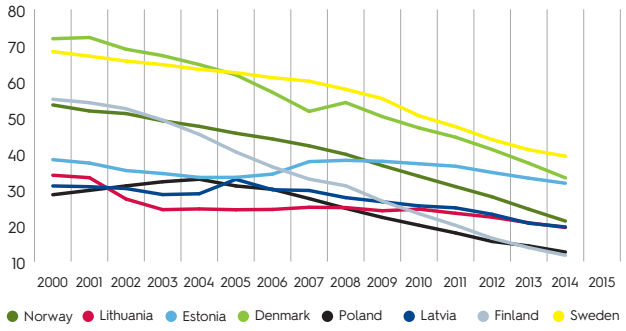
(INTERNATIONAL TELECOMMUNICATION UNION)



APP. **4**

Fixed Telephone Subscriptions/ 100 people 2000-2014

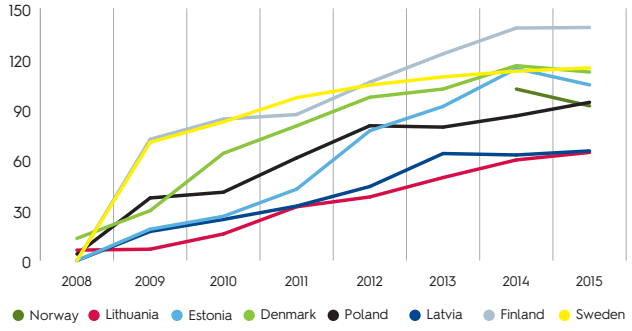
(INTERNATIONAL TELECOMMUNICATION UNION)



APP. **5**

Mobile Broadband Subscriptions/100 people 2008-2015

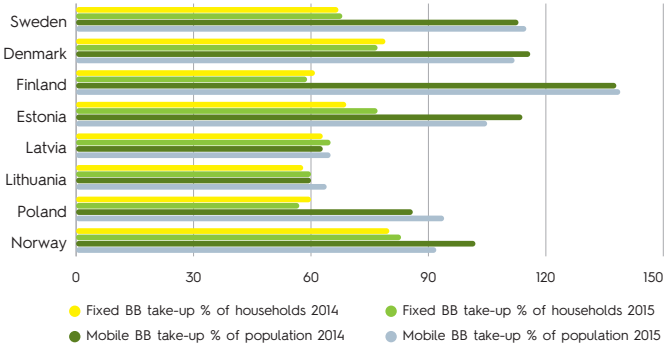
(DIGITAL AGENDA SCOREBOARD)



APP. **6**

Fixed and Mobile Broadband Penetration 2014 and 2015

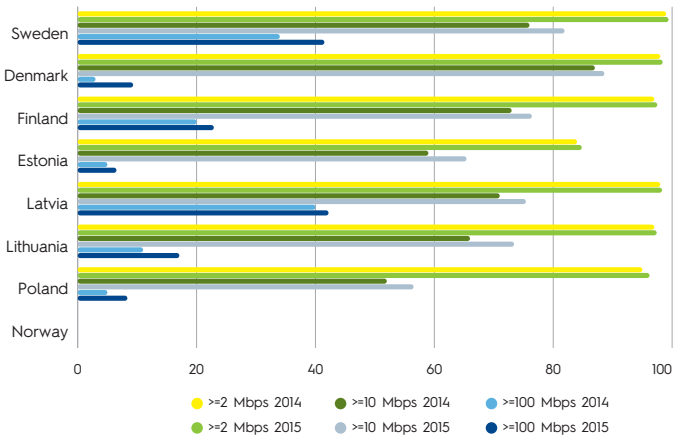
(DIGITAL AGENDA SCOREBOARD)



APP. 7

Share of Fixed BB Subscriptions with different Bandwidths 2014 and 2015

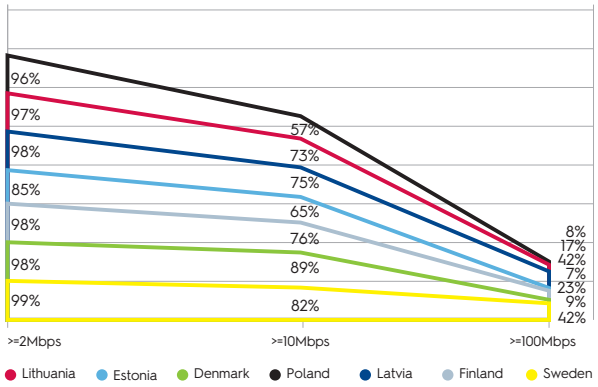
(DIGITAL AGENDA SCOREBOARD)



APP. 8

Share of Bandwidths (% of fixed BB Subscriptions) 2015

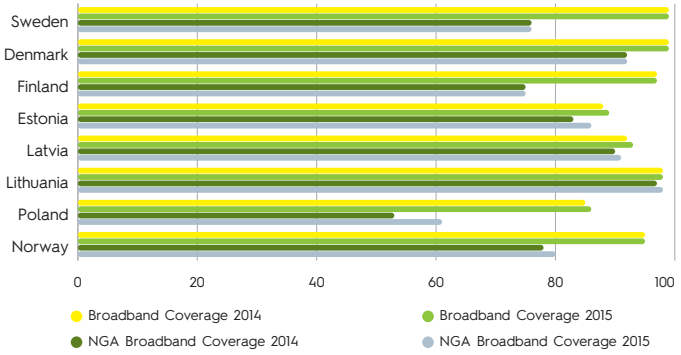
(DIGITAL AGENDA SCOREBOARD)



APP. 9

Broadband and NGA Broadband Coverage (% Households) 2014 and 2015

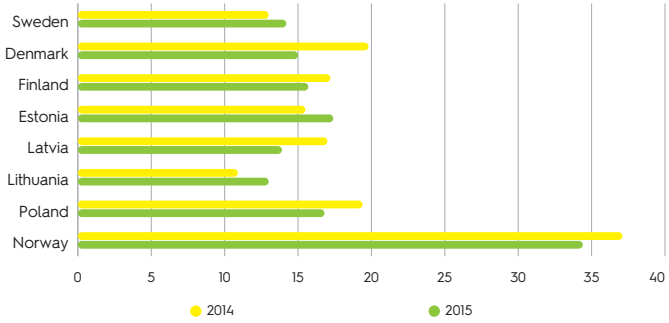
(DIGITAL AGENDA SCOREBOARD)



APP. 10

Monthly Price for Internet Access 8-12 Mbps (Median Price in Euro) 2014 and 2015

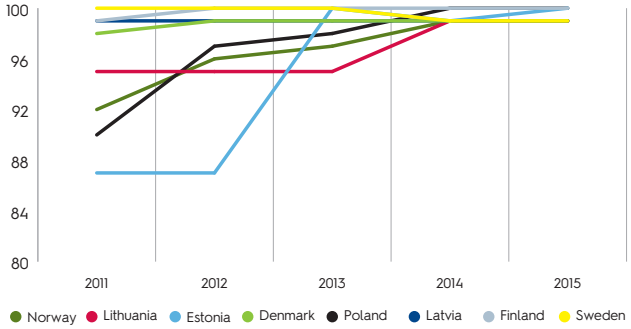
(DIGITAL AGENDA SCOREBOARD)



APP. 11

Advanced 3G Mobile Broadband Coverage (% Households) 2011-2015

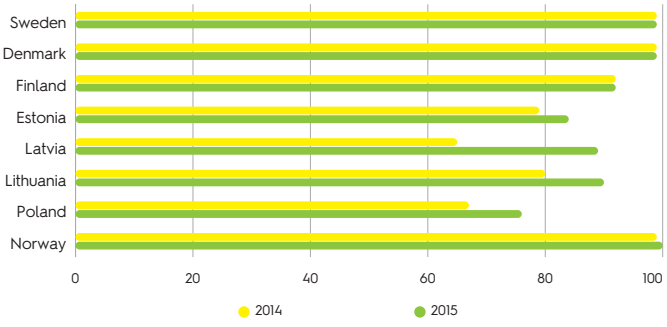
(DIGITAL AGENDA SCOREBOARD)



APP. 12

LTE Mobile (4G) Broadband Coverage (% Households) 2014 and 2015

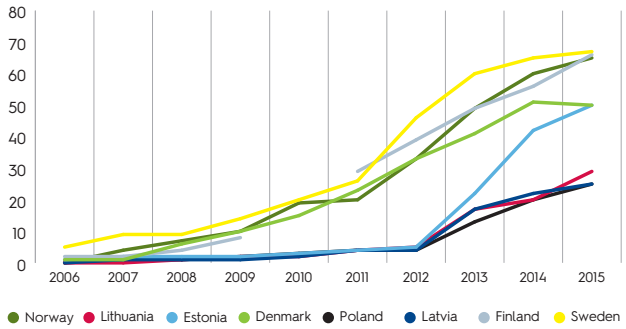
(DIGITAL AGENDA SCOREBOARD)



APP. **13**

Used Mobile Phone to Access Internet (% of individuals) 2006-2015

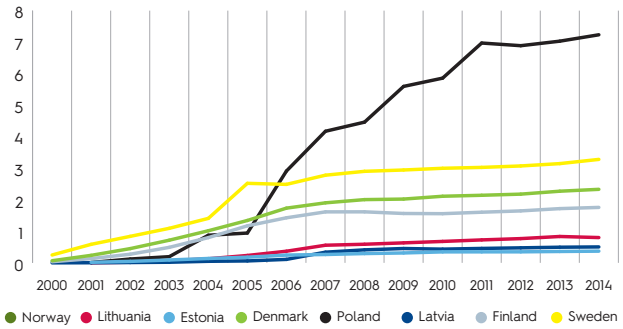
(DIGITAL AGENDA SCOREBOARD)



APP. **14**

Total Fixed Broadband Subscriptions 2000-2014 (millions)

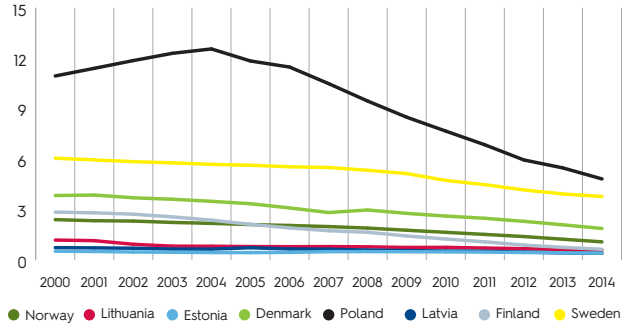
(INTERNATIONAL TELECOMMUNICATION UNION)



APP. **15**

Total Fixed Telephone Subscriptions 2000-2014 (millions)

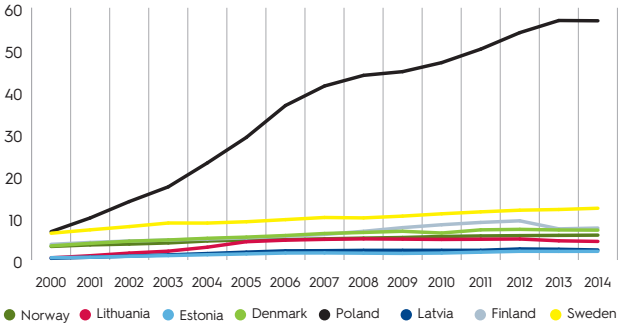
(INTERNATIONAL TELECOMMUNICATION UNION)



APP. **16**

Total Mobile Phone Subscriptions 2000-2014 (millions)

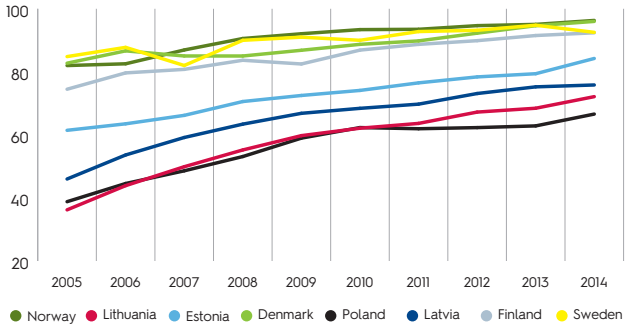
(INTERNATIONAL TELECOMMUNICATION UNION)



APP. **17**

Internet Users/100 people 2005-2014

(WORLD BANK)



APP. **18**

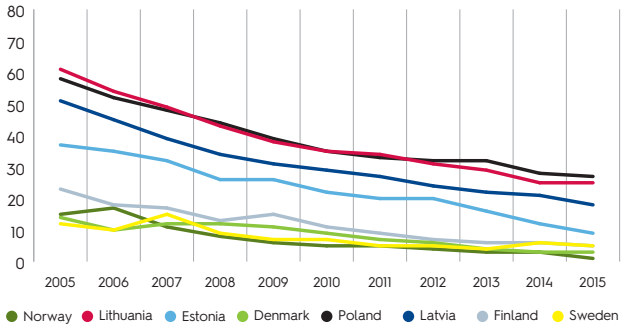
Internet Users/100 people 2005, 2013 and 2014

(WORLD BANK)

APP. 19

Never Used Internet 2005-2015 (% Population)

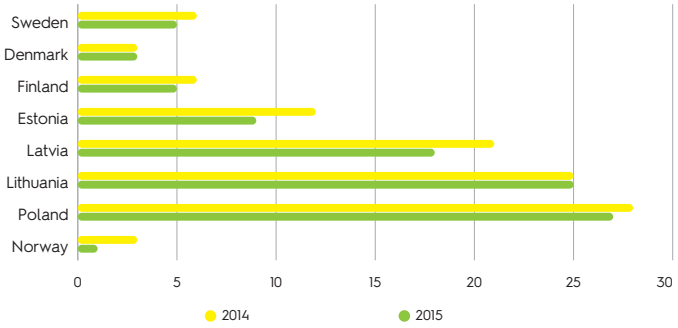
(DIGITAL AGENDA SCOREBOARD)



APP. 20

Never Used Internet 2014 and 2015 (% Population)

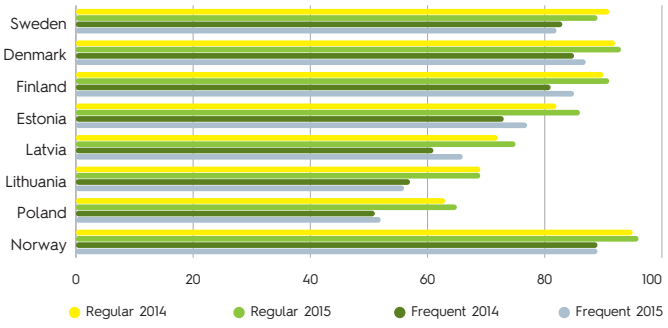
(DIGITAL AGENDA SCOREBOARD)



APP. 21

Regular and Frequent Internet Users (% Population) 2014 and 2015

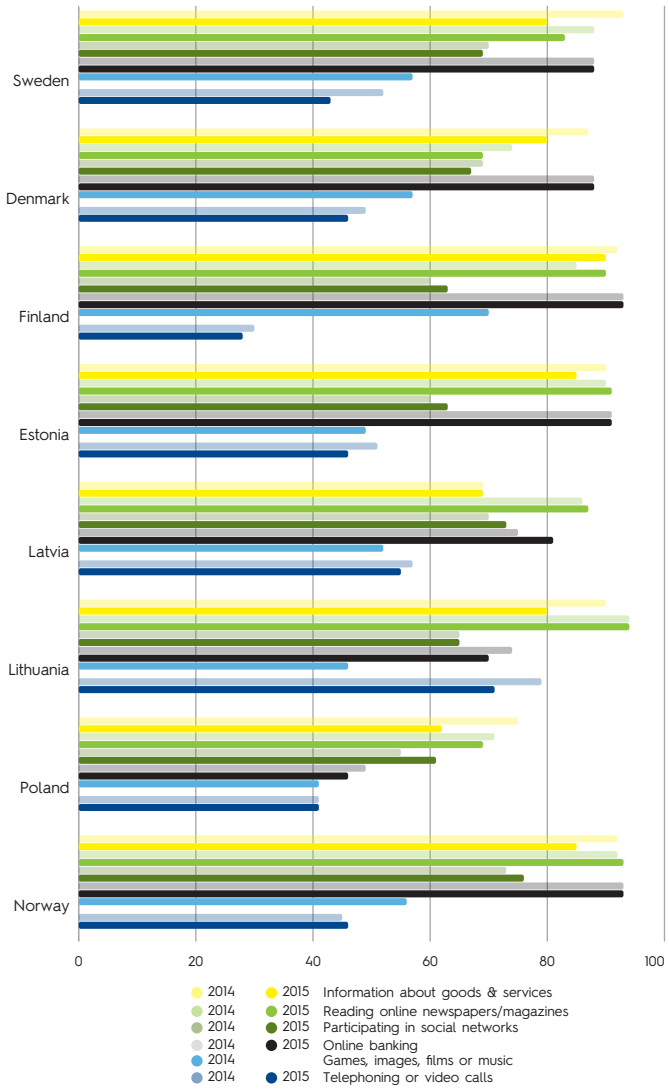
(DIGITAL AGENDA SCOREBOARD)



APP. 22

Online Activities (% of Internet Users last 3 months) 2014 and 2015

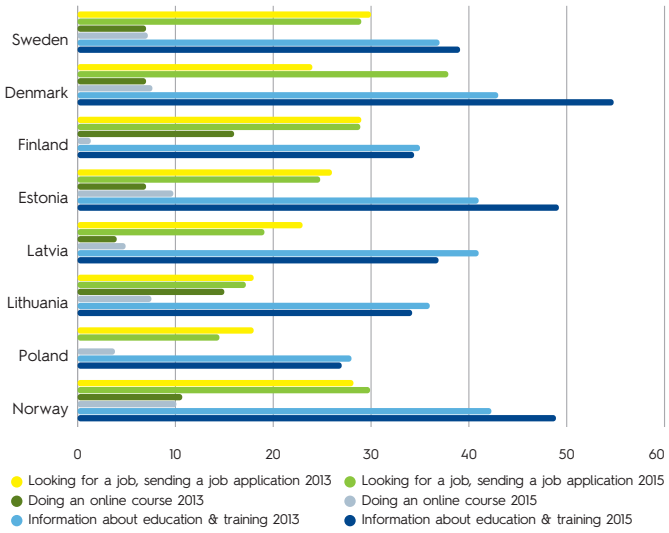
(DIGITAL AGENDA SCOREBOARD)



APP. 23

Online Labor Market Activities (% of Internet Users last 3 months) 2013 and 2015

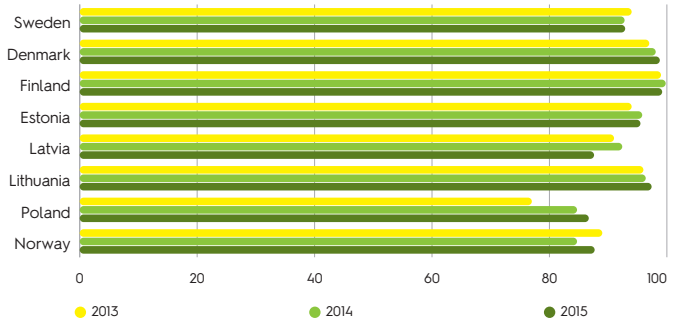
(DIGITAL AGENDA SCOREBOARD)



APP. **24**

Share of Enterprises with a Fixed Broadband Connection 2013-2015 (%)

(DIGITAL AGENDA SCOREBOARD/EUROSTAT)



APP. **25**

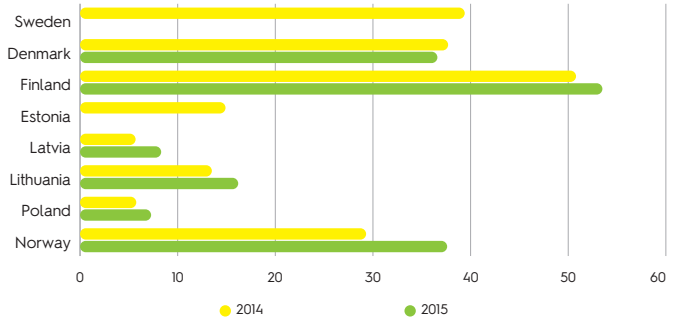
Enterprises Providing Employees with Portable Devices (%) 2011-2015

(DIGITAL AGENDA SCOREBOARD)

APP. **26**

Share of Enterprises using CC services 2014 and 2015

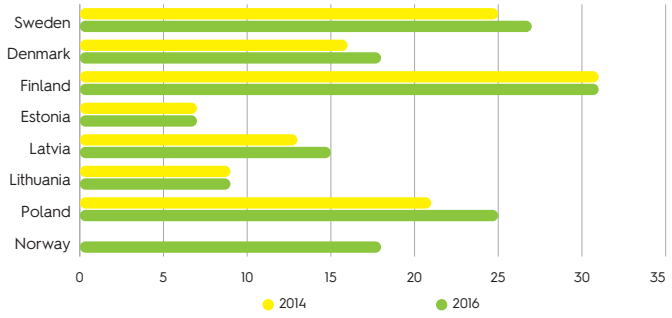
(DIGITAL AGENDA SCOREBOARD)



APP. **27**

Educational Institutions with Programs in Science, Technology, Engineering, Computer Science and Mathematics 2014 and 2016

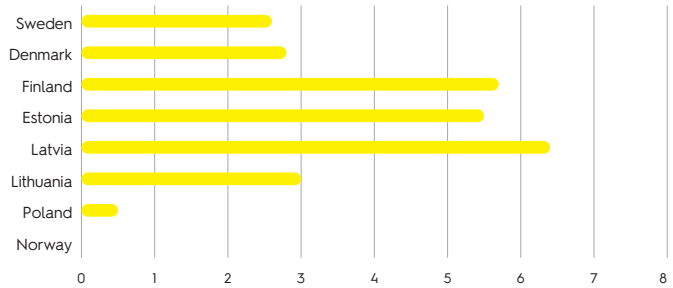
(AUTHOR'S CALCULATION)



APP. **28**

Educational Institutions / 100k People 2014

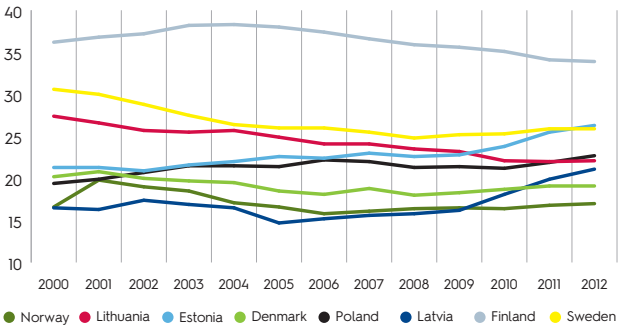
(AUTHOR'S CALCULATION)



APP. **29**

Enrolled in Science, Mathematics, Computer Science and Engineering (% of Students) 2000-2012

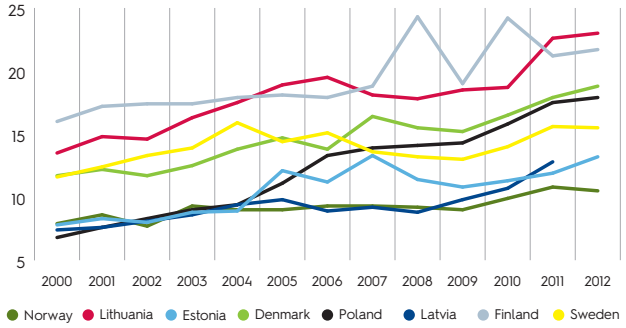
(EUROSTAT)



APP. **30**

Graduates in Mathematics, Science and Technology 2000-2012 (1000/people aged 20-29)

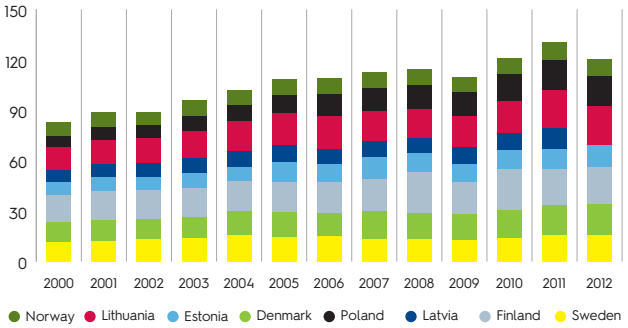
(EUROSTAT)



APP. **31**

Graduates in Mathematics, Science and Technology in the region 2000-2012 (1000/people aged 20-29)

(EUROSTAT)



APP. **32**

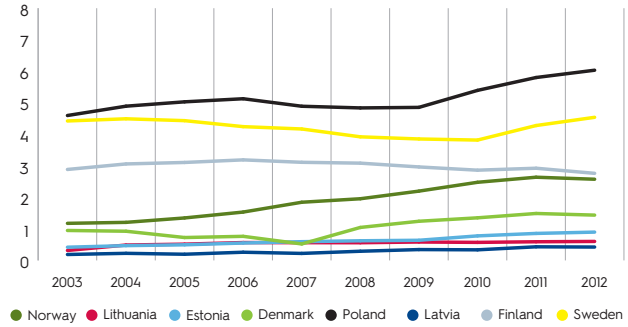
STEM Graduates / 1000 Individuals 20-29 Years Old 2012 and 2013

(DIGITAL AGENDA SCOREBOARD)

APP. **33**

PhD Students in Science, Mathematics and Computer Science 2003-2012 (thousands)

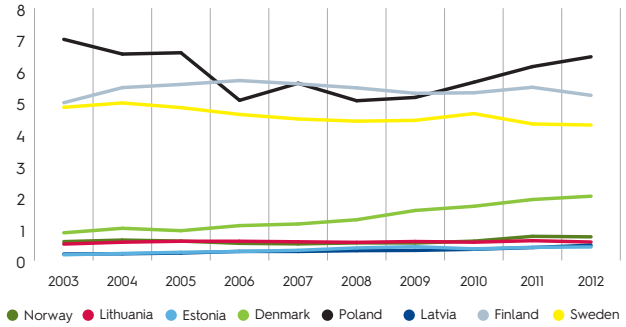
(EUROSTAT)



APP. **34**

PhD Students in Engineering, Manufacturing and Construction (thousands) 2003-2012

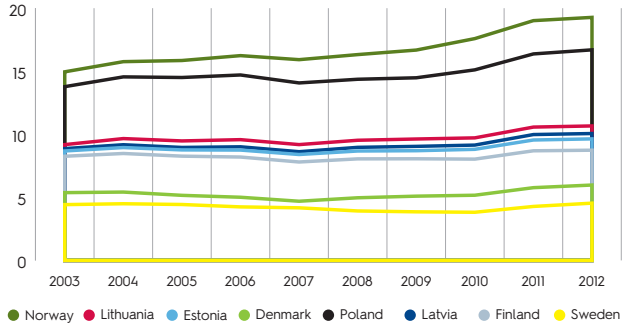
(EUROSTAT)



APP. **35**

PhD Students in Science, Mathematics and Technology in the region (thousands) 2003-2012

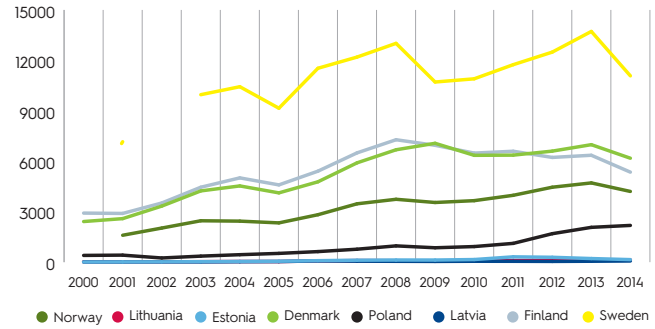
(EUROSTAT)



APP. 36

Total Private R&D Expenditure in Science and Technology (million USD) 2000-2013

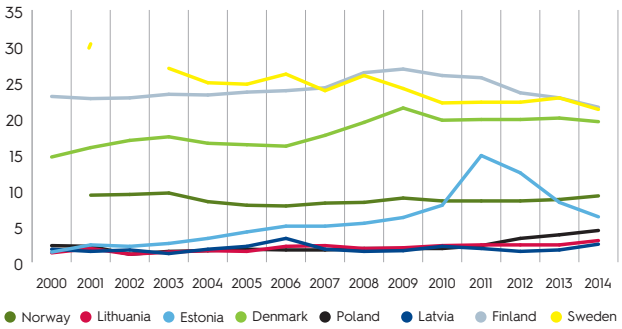
(EUROSTAT+OECD)



APP. 37

Private R&D Expenditure in Science and Technology as % of GDP 2000-2014

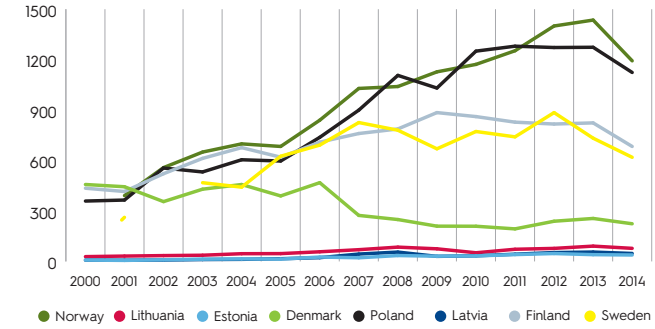
(EUROSTAT+OECD)



APP. 38

Total Public R&D Expenditure in Science and Technology (million USD) 2000-2014

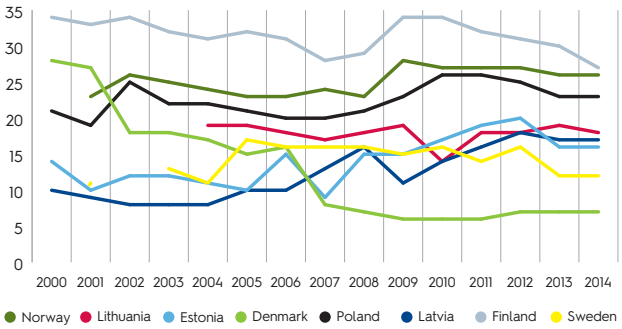
(EUROSTAT+OECD)



APP. 39

Public R&D Expenditure in Science and Technology as % of GDP 2000-2014

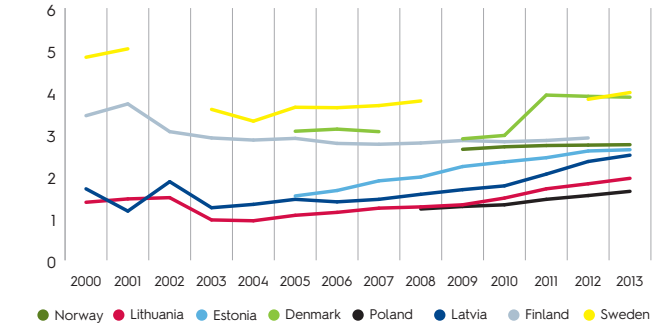
(EUROSTAT+OECD)



APP. 40

Share of Employment in ICT Service Sector 2000-2013

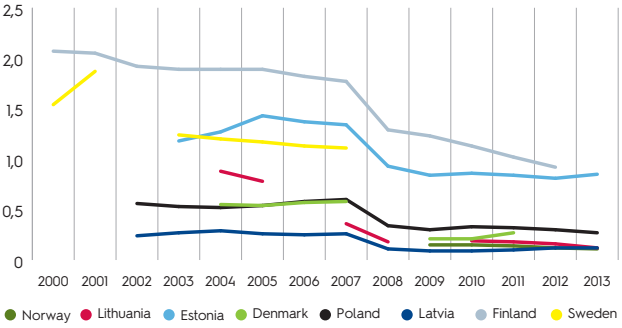
(EUROSTAT)



APP. 41

Share of Employment in ICT Manufacturing Sector 2000-2013

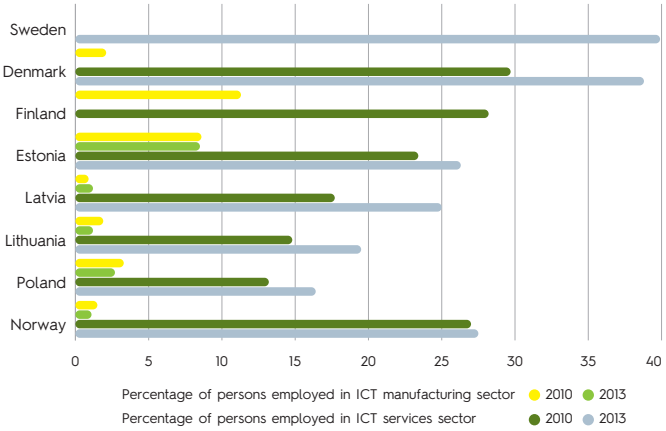
(EUROSTAT)



APP. 42

Share of Employment in ICT Manufacturing and Service Sector 2010 and 2013

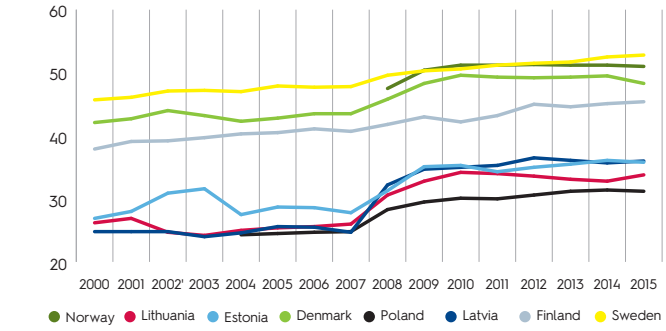
(EUROSTAT)



APP. 43

Share of Employment in KIBS 2000-2015 (%)

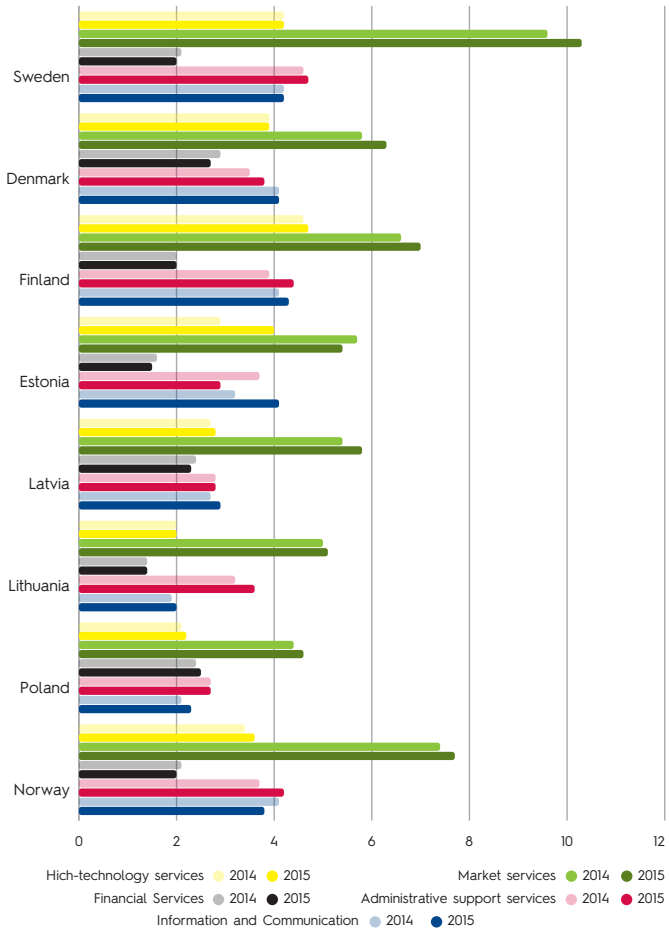
(EUROSTAT)



APP. 44

Employment in KIBS 2014-2015 (%)

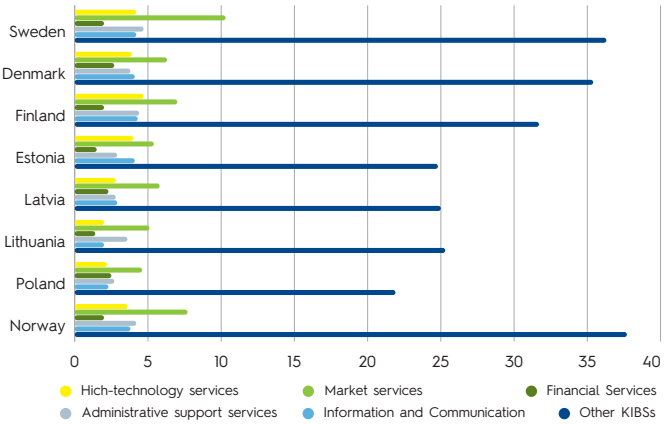
(EUROSTAT)



APP. 45

Employment in KIBS 2015 (%)

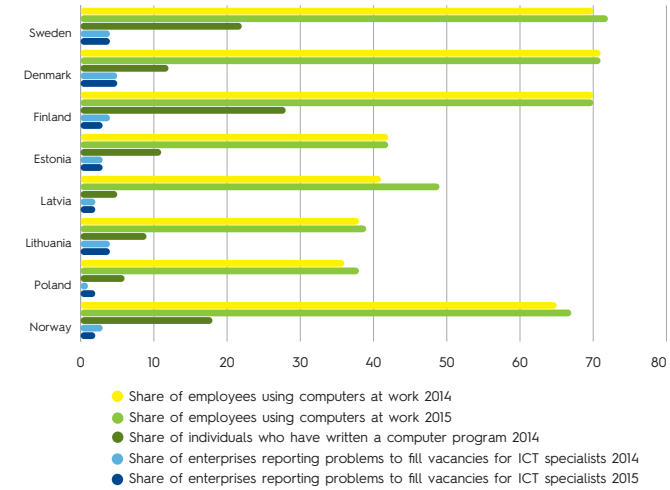
(EUROSTAT)



APP. 46

Variations of Working in ICTs 2014 and 2015 (%)

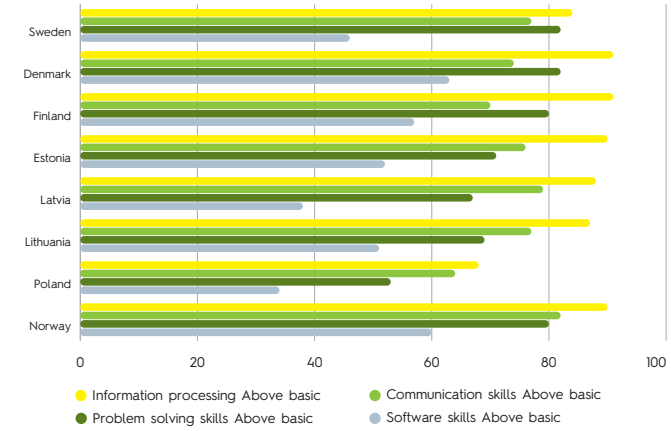
(DIGITAL AGENDA SCOREBOARD)



APP. **47**

People with Medium or High Internet Skills (% of individuals) 2015

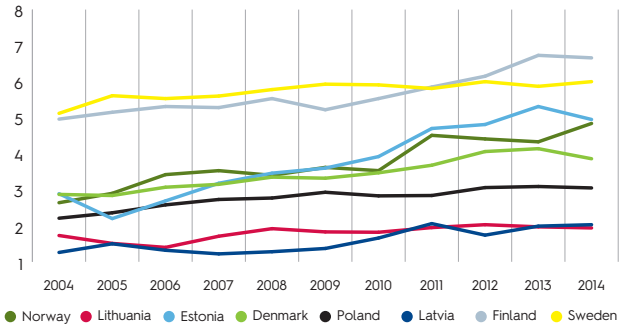
(DIGITAL AGENDA SCOREBOARD)



APP. **48**

Share of Employed People with ICT Specialist Skills 2003-2014 (%)

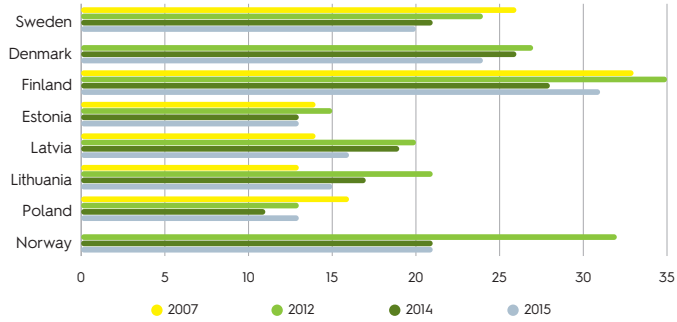
(DIGITAL AGENDA SCOREBOARD)



APP. **49**

Manufacturing firms with ICT/IT specialists (%) 2007, 2012, 2014 and 2015

(EUROSTAT)



APP. **50**

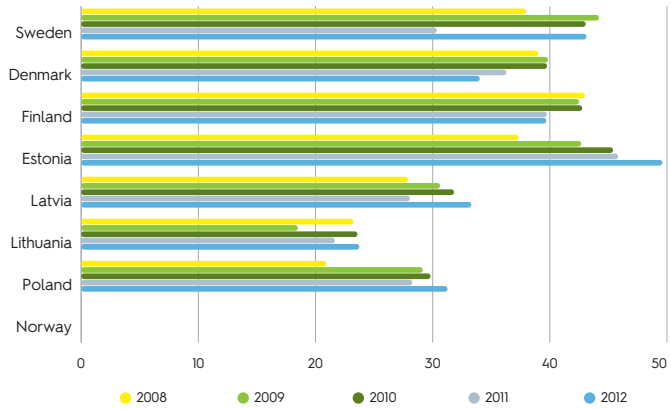
Firms in Information and Communication with ICT/IT specialists (%) 2014 and 2015

(EUROSTAT)

APP. **51**

KIBS B2B % of GDP 2008-2012

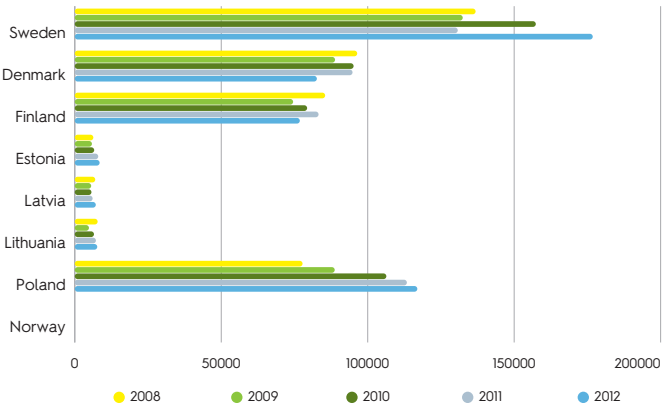
(EUROSTAT)



APP. **52**

Production Value for KIBS (Millions Euro) 2008-2012

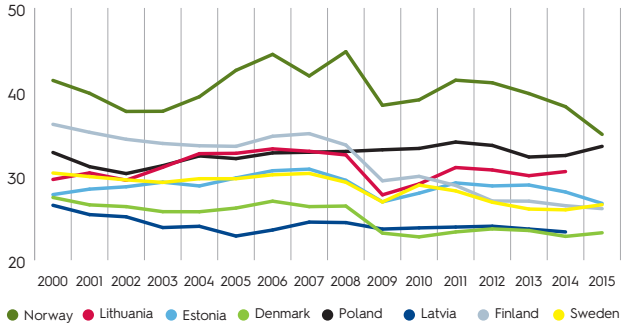
(EUROSTAT)



APP. 53

Industry, Value Added % of GDP 2000-2015

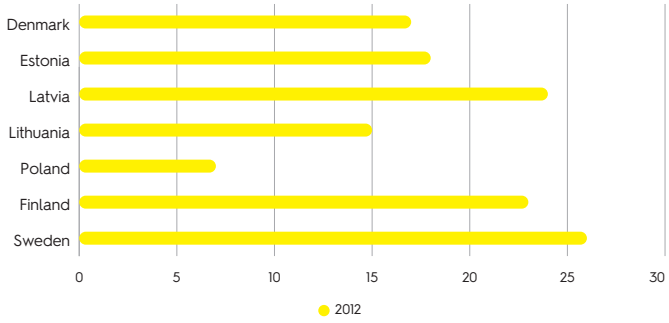
(WORLD BANK)



APP. 54 1

Start-ups in Computer programming, consultancy and related activities per 100,000 workers 2012

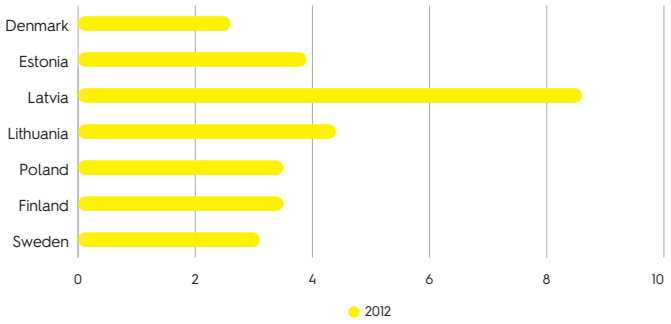
(EUROSTAT)



APP. 54 2

Start-ups in Information service activities per 100,000 workers 2012

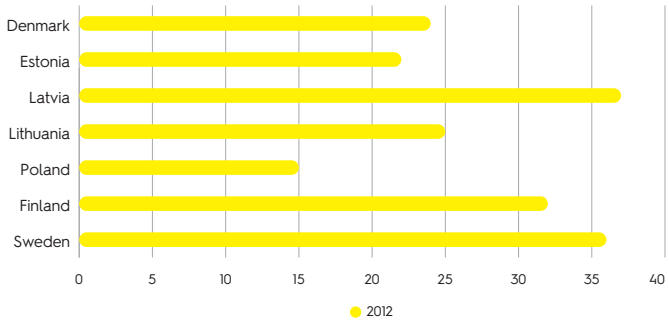
(EUROSTAT)



APP. 54 3

ICT start-ups per 100,000 workers 2012

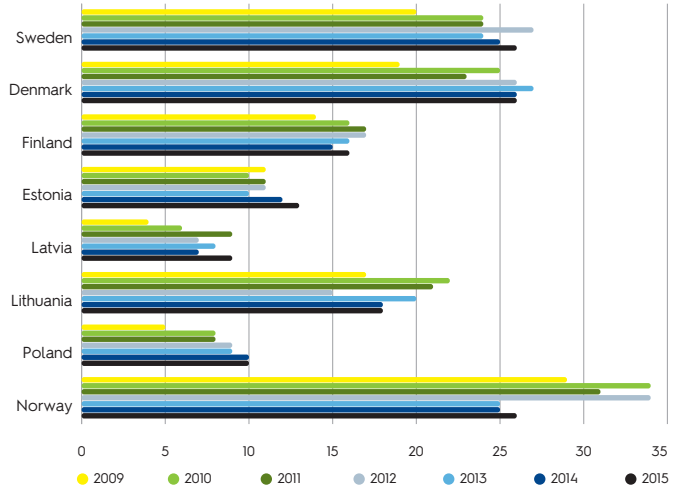
(EUROSTAT)



APP. 55

Share of Enterprises Making Online Sales (Financial Sectorexcluded) 2009-2015

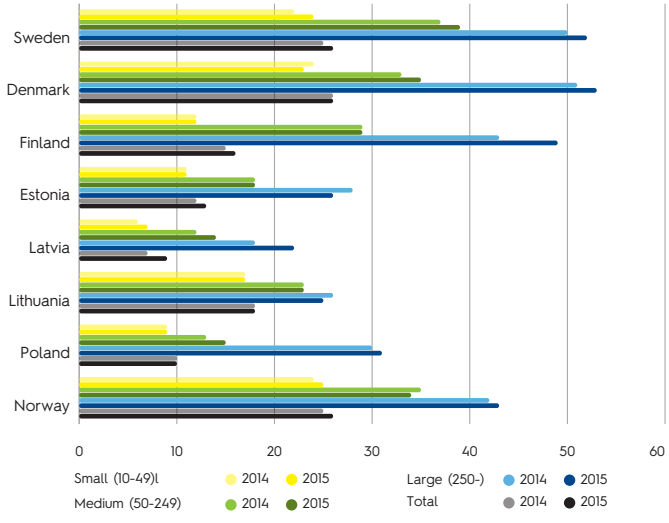
(EUROSTAT)



APP. 56

Share of Enterprises Making Online Sales 2014 and 2015 (%)

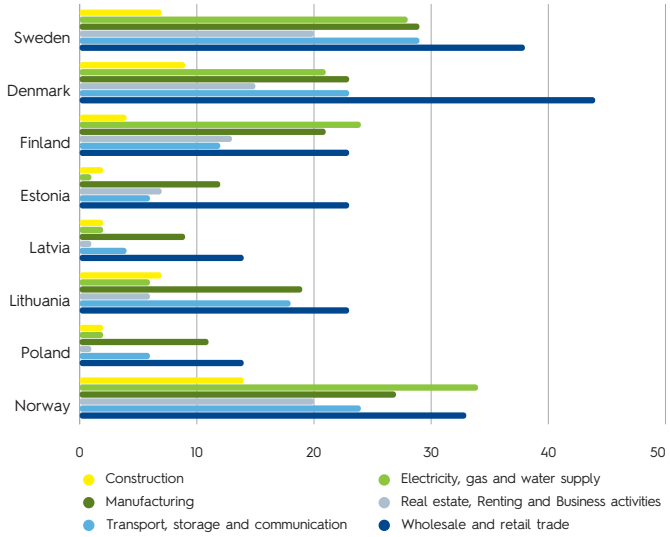
(EUROSTAT)



APP. **57**

Share of Enterprises Making Online Sales by Sector 2015 (%)

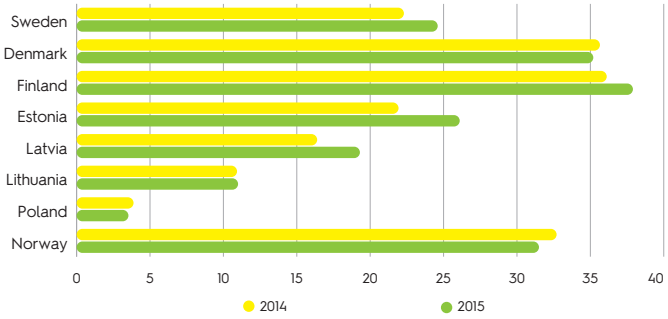
(EUROSTAT)



APP. **58**

Cross-border EU business to consumer (B2C) purchases 2014-2015 (% of population)

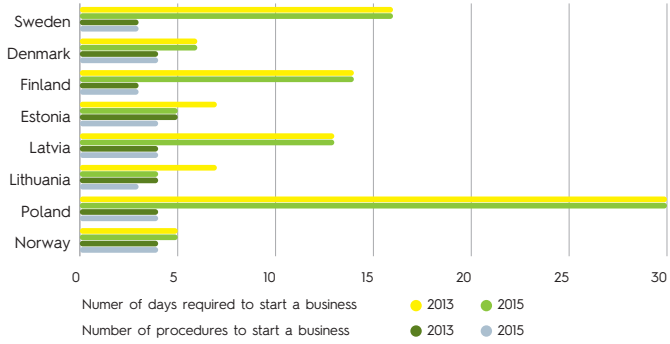
(EUROSTAT)



APP. **59**

Days and Procedures Required to Start a Business 2013 and 2015

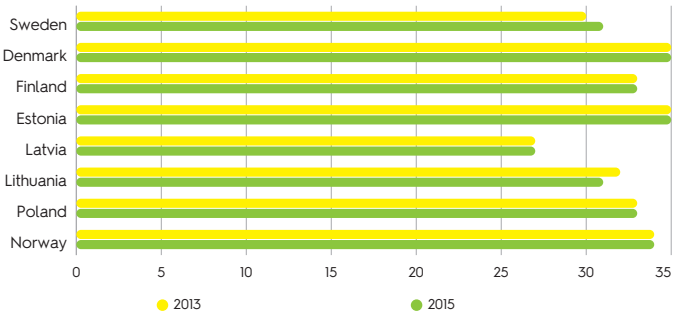
(WORLD ECONOMIC FORUM)



APP. **60**

Number of Procedures to Enforce a Contract 2013 and 2015

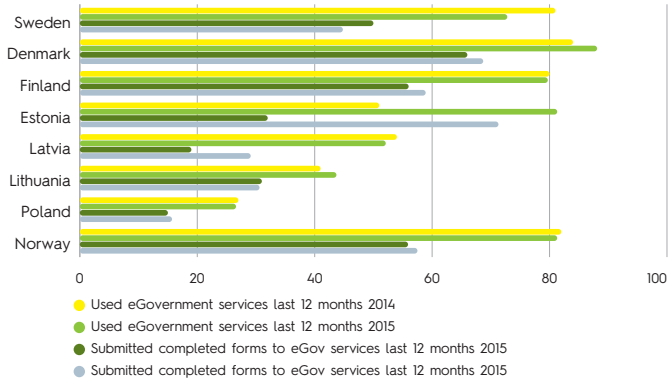
(COUNTED FROM THE MOMENT A LAWSUIT IS FAILED IN COURT UNTIL PAYMENT)
(WORLD ECONOMIC FORUM)



APP. **61**

Share of Citizens Using eGov Services 2014 and 2015 (%)

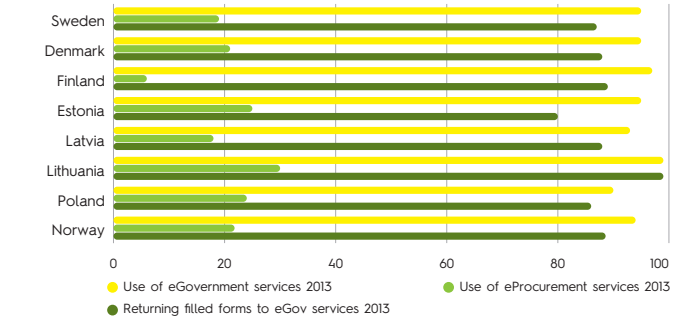
(DIGITAL AGENDA SCOREBOARD)



APP. **62**

Share of Enterprises Using eGov Services 2013 (%)

(DIGITAL AGENDA SCOREBOARD)



APPENDIX 2: LIST OF CITY NETWORKS

This appendix includes a list of the cross-border city networks included in the sample in section 3.3.

- **Baltic Metropoles Network (BaltMet)**
  http://www.baltmet.org/members-and-contacts
- **C40 – Climate Leadership Group**
  http://www.c40.org
- **European Cyclists' Federation**
  https://ecf.com/community/our-members
- **EUROCITIES**
  http://www.eurocities.eu/eurocities/members
- **Union of Capitals of the European Union (UCEU)**
  http://www.ucue.org/UCEU.htm
- **ICLEI – Local Governments for Sustainability**
  http://www.iclei.org/iclei-members/iclei-members.html?memberlistABC=D
- **European Cities Action network towards a Drug-free society (ECAD)**
  http://www.ecad.net
- **European Coalition of Cities Against Racism (ECCAR)**
  http://www.eccar.info/members
- **The International Coalition of Cities against Racism**
  http://www.unesco.org/new/en/social-and-human-sciences/themes/fight-against-discrimination/coalition-of-cities/
- **Strong Cities Network**
  http://strongcitiesnetwork.org/strong-cities/
- **EnergyCities**
  http://www.energy-cities.eu/cities/members_in_europe_en.php
- **Sister Cities International**
  http://www.sister-cities.org/member-area
- **International Association of Science Parks and Areas of Innovation (IASP)**
  http://www.iasp.ws/by-country
- **Union of the Baltic Cities**
  http://www.ubc.net
- **Live Baltic Campus**
  http://livebalticcampus.eu/about/
- **Greater Copenhagen**
  http://www.greatercph.com
- **Trade Councils**
  http://estland.um.dk/en/the-trade-council/regional-cooperation/
- **Capital City cooperation**
  http://www.tallinn.ee/valissuhted/Tallinn-Riia-Vilnius-1993
- **The Scandinavian 8 Million City**
  http://www.8millioncity.com
- **Twin Cities**
  http://subsites.odense.dk/subsites5/english/topmenu/about/twin%20cities

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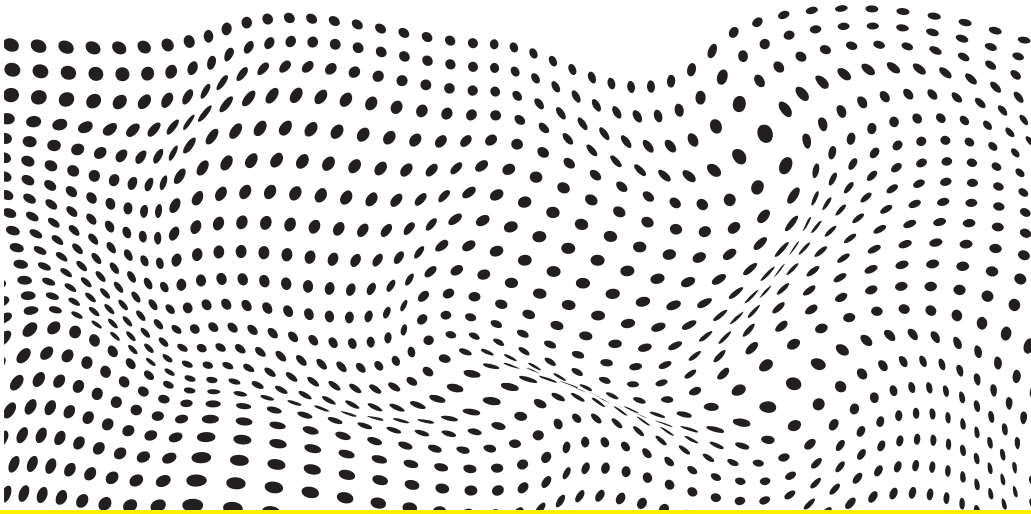

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