Coding the Future

The challenge of meeting future e-skill demands in the Nordic-Baltic ICT hub

Discussion paper from Top of Digital Europe

sustainable growth innovation competitiveness
Baltic Development Forum
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Foreword

The Baltic Sea Region has established itself as a front-runner in the ICT sector. Over the last decade, it has succeeded in attracting huge foreign direct investment in tech companies. However, global competition is booming and other nations are quickly catching up to the traditionally technologically advanced countries in the North. The region needs to keep up the pace in order to secure its position.

The Baltic Sea Region needs to ensure that the public and private sector work closely together, and the region as a whole needs to identify and take action on key strategic priority areas within the digital economy to maintain international competitiveness.

To meet the challenges and seize opportunities in the dynamic and rapidly changing ICT landscape, Baltic Development Forum (BDF) and Microsoft joined forces to establish the first regional ICT think tank, "Top of Digital Europe", to support and promote the Baltic Sea Region as a leader in the ICT sector. "Top of Digital Europe" is a politically neutral, non-profit think tank with the purpose of facilitating dialogue on how the region can fuel the digital economy, grow stronger, and become an even more important player on the global ICT stage.

In June 2014, "Top of Digital Europe" launched its first report, "Searching for the Micro-multinationals". In this second report, the think tank zeros in on e-skills and the future relationship between learning and working.

This paper is not a scientific report on e-skills based on advanced analysis. It is a discussion paper with the aim to add a regional perspective on the debate on e-skills and the future relationship between learning and working. In addition, the paper aims at giving a snapshot of the situation in the Baltic Sea Region, displaying the level of e-skills and the diversity of approaches and experiences – a diversity that is part of the region's stronghold.

The paper consists of four parts: ***The first part*** consists of a survey on the relationship between higher education and industry. The survey was conducted among universities, ICT companies, ICT startups, and venture capitalists in Sweden, Finland, Norway, Denmark, and Estonia. The results point to tendencies with respect to the relationship between education and industry. ***The second part*** is a brief overview of the debate on the future need for e-skills, summarized in three general challenges. ***The third part*** summarizes recommendations and questions to provide a starting point for further discussions and joint action. ***The fourth part*** is an appendix with a brief snapshot of the e-skills among the population in the countries of the Baltic Sea Region, picturing the region's readiness to tackle the issues raised. Combined, the survey tendencies, the challenges described, the questions raised, and the country snapshots should stimulate to explore new perspectives and ideas.

The survey was outlined on the initiative of "Top of Digital Europe" and supported by European Schoolnet. It was financed by Microsoft and conducted by Cohn & Wolfe together with local partners in the different countries.

Introduction

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When the IT bubble burst in the early 2000's, the general opinion seemed to be that the IT revolution was over before it had even really begun. Today, however, digital technologies have to a varying degree been integrated into most if not all parts of society, and technology has become a more intimate part of our daily lives. To many people, a smartphone or a tablet is the last thing they see before they go to sleep and the first thing they see in the morning. People buy items from far away, date, learn new things, and keep in touch with old friends through devices they can fit in their pockets (*The New Digital Age*, Schmidt and Cohen, 2013). New small micro-multinational businesses find customers all over the world (*Searching for the Micro-Multinationals*, Top of Digital Europe, 2014).

Although there is no single revolutionary moment in time to point to, there has been a dramatic shift in the use of ICT since the IT bubble. We have slowly been moving into a global information society for a long time, and now we are starting to see the truly deep impact of this creeping revolution. The future is increasingly written in programming code and programmers are becoming builders of societies (*The Computer Boys Take Over*, Ensmenger, 2010).

However, there is a growing gap in e-skills, meaning that there is an excess demand for digital skills that is not being met. Unemployment, especially youth unemployment, is a rising issue, whereas the interest in ICT programs in higher education seems to be declining. This equation does not add up.

The countries in the Baltic Sea Region have a history of open economies and well-educated workforces. In combination with their timely and historically progressive adoption of ICT and digitization, this has put them in a unique position in the emerging information economy. They also together have unique preconditions for addressing specific cross border barriers and becoming growth enablers (*Priorities towards a Digital Single Market in the Baltic Sea Region*, BDF and BCCA, 2012). Fast-forward to 2015 and it is clear that the region has established itself as a technological super cluster. Not only have the countries in the region fostered a number of world-leading companies built upon innovation and technological prowess, but they have also pioneered technologies like the world's first fully automatic cellular phone system (NMT, created almost 40 years ago).

The countries in the region are at the forefront of this development because of their overall high ICT maturity and technology adoption, but unless they are prepared to meet the challenges ahead, in particular the growing gap in e-skills, they could easily be left behind in the race for global competitiveness. For the latest statistics on digital performance and competences of the Baltic Sea Region, see the country snapshots in the appendix of this paper.

What will it take to maintain and develop a Nordic-Baltic ICT environment able to foster the next Ericsson, Skype and Nokia? Or – for that matter – what will it take to nurture the innovators behind the next Navision, Minecraft, or groundbreaking ideas like the open source movement?

For the last couple of years, EU-wide research has pointed to the growing demand for digitally skilled workers in order to maintain long-term competitiveness and a continued robust level of innovation in Europe. Evidence shows that there is a growing gap emerging between the demand and supply of ICT specialists in Europe. It has been projected that this gap could reach 900.000 by 2020 if not addressed (*Scoreboard 2014 – Digital inclusion and skills in the EU*, 2014). In the Baltic Sea Region the estimated gap by 2020 amounts for more than 100,000 jobs.

This scenario triggered the think tank "Top of Digital Europe" to investigate these issues further and initiated the work with this discussion paper. Microsoft and Microsoft's network of thousands of regional partner companies have experienced increasing difficulty in recruiting talent with the necessary technical skills. The region needs more developers and graduates with general ICT skills in order to ensure a healthy pipeline of talent and secure the strong position of the region's ICT sector.

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IT tendencies in education and industry

A Nordic-Baltic snapshot

This section is dedicated to a short survey in selected Nordic and Baltic countries on the relationship between higher education and industry with respect to some e-skill-specific issues.

SURVEY METHOD AND PARTICIPANTS

The survey consists of interviews with 10 universities, 10 leading ICT companies and 10 ICT startups, as well as venture capitalists in Sweden, Finland, Norway, Denmark, and Estonia. The survey was outlined on the initiative of "Top of Digital Europe", conducted by Cohn & Wolfe together with local partners in the different countries, and completed at the end of 2014.

The participating companies represent the leading actors in each country and were chosen from employer branding top lists. The participating universities are the leading schools in each country offering degrees in computer science, programming, or equal curricula. The startups in the survey were chosen from top-lists presented by Wired, EU Startups, Internetworld, Arctic Startup, The Methodologist, and Red Herring. The venture capitalists included in the survey were chosen from the member list at each country's "Venture Capital Association" homepage. All make early investments in ICT-driven companies. To get a deeper understanding of the needs of the venture capitalists, five in-depth interviews were conducted by phone.

The results do not give detailed accounts or in-depth analyses of specific countries. Instead, they point to tendencies and provide a snapshot of the state of the region with respect to the relationship between educators and employers. The survey questions are divided according to how the different actors perceive and value different parts of the e-skill spectrum.

KEY TENDENCY #1: CODING SHOULD START EARLY – PERHAPS EVEN VERY EARLY

Children should learn to code as pre-teens - or even younger - according to the respondents of the survey. But exactly how young should children be when introduced to the art of coding?

A minority of respondents recommends that the starting age for learning how to code should be as young as 3-6 years old. This is the recommendation from one third of the surveyed venture capitalists. Two thirds of the universities in the region believe that coding should be introduced between 7-13 years of age, and half of start-ups in the region think age 10-13 is appropriate.

Looking at the situation in the countries included in this survey, the respondents' hopes are far from fulfilled. Even though all the countries in the region have a fairly high computer density in schools, especially if you include the students' personal computers, up till now, only Finland and Estonia have introduced coding and programming as an individual subject in primary school curricula. In Finland this will come into effect in 2016. Latvia may follow suit already in 2015.

In total, 94 percent of the startups, 90 percent of the universities and 83 percent of the ICT companies think that programming *should* be introduced as a subject in primary and/or secondary school. This should provide apt incentives for further investigation.

KEY TENDENCY #2: WANTED: EXTROVERTED PROGRAMMERS!

So far, the typical skilled programmer has been an introverted computer geek with an almost 'magical' ability to talk to machines. This survey set out to investigate whether this paradigm will persist into the future and the answer is a resounding 'yes!' More than ever, we will need people with deep technical knowledge of computer science and cutting-edge programming skills. We have only just begun to investigate the opportunities of big data, and the R&D departments of leading technology companies are still focused on developing, optimizing, or adapting hardware for future innovations.

However, the introverted programming geek cannot survive alone. Our survey shows that the future looks exceptionally bright for a different type of individual: The professional who manages to combine a solid base in object-oriented programming and an edge on mobile platforms with a user-centric and solutions-based outlook and an entrepreneurial and collaborative mindset.

In other words: While the classic 'geek persona' is still very much in demand and will continue to be so, ICT companies, start-ups, and venture capitalists are also on the look-out for individuals with a more versatile skill set.

Our survey shows that universities, ICT companies, and start-ups rate team collaboration skills as the most important trait for a software developer, above qualifications such as deep technical knowledge, extensive higher education and problem solving/solution oriented skills. When it comes to social and cross-cultural skills however, these were valued higher by ICT companies and venture capitalists than by universities.

"We live in a more and more international world. It's good to have experiences from other countries and insights into different cultures."

Dan Ekelund,
Industrifonden

"It is important to have at least one person in a team who has an entrepreneurial spirit and one person with a passion for innovation. If each of our software teams has 7 people, then for example the IT Business analyst should be about innovation and IT team/project manager should include entrepreneurial thinking."

Meelis Lang, Helmes,
Head of Software Development

KEY TENDENCY #3: MOBILE APPS AND CLOUD COMPUTING MAY BE UNDERSERVED

Mobile apps and cloud computing have become central elements of daily consumer behavior. In line with this, the survey findings indicate that mobile app development skills and cloud computing environment skills are deemed to be very important by start-ups and venture capitalists. However, they are less important to ICT companies and universities (in the case of cloud based environments).

As an example, four out of five interviewed venture capitalists believe mobile app development is important. Only 51 percent of ICT companies share this view. Additionally, 74 percent of start-ups value cloud based skills but only 54 percent of universities feel the same. In Sweden, this difference is even more staggering. Here, 75 percent of start-ups in the survey value cloud based programming, but only one third of the universities do.

This tendency is perhaps not that surprising. Universities need to cater to many different needs and therefore maintain a relatively broad focus when it comes to IT. At the same time, start-ups and venture capitalists focus on new trends and are more open to risk-taking and trial and error.

TENDENCIES POINT TO DISCREPANCIES BETWEEN BUSINESS AND ACADEMIA

The survey findings and the three key tendencies point to a discrepancy between business needs and educational priorities in the region. Educational institutions may be rooted in a more traditional academic mindset:

Educational curricula across the region reflect the current needs of ICT companies well. However, the view of industry and university survey respondents on when children should be introduced to coding does not reflect current academic practice in the region, with the exception of Finland and Estonia.

Educational institutions value social and cross cultural skills significantly lower than start-ups and ICT companies.

Mobile app development skills and cloud computing environment skills seem very important to start-ups and venture capitalists, but the ICT curricula priorities of universities in the Nordic/Baltic countries do not mirror this demand.

On this basis, we believe there is work to be done on behalf of educational institutions in order to catch up with the times and properly reflect the needs of the market in their ICT curricula and priorities. Similarly, industry as employers should be more proactive and explore new ways of formal and informal collaborations with the educational institutions.

The Broader Perspective: Three e-Skill Challenges

3

The Silicon Valley entrepreneur Marc Andreessen coined the phrase "software is eating the world". By this he meant that new software-based business models increasingly substitute for and outcompete non-digital business models such as the bookstore, the vinyl record, or the electronics store. Moreover, the spread and use of software generates digital data, or big data, which can in turn be used by managers to improve their businesses, by customers to quantify their behavior, and by entrepreneurs to develop new services and products (*Big Data*, Mayer-Schönberger and Cukier, 2013).

This new landscape of software and data create a lot of new opportunities but also create new challenges, and they all depend to some degree on computer code. An important and growing part of our future lives is written in programming code. The big question is if enough of us will be able to read it. It is a question of e-skills.

In 1986, in the early years of the internet as we know it, the Internet Engineering Task Force (IETF) was formed to create and maintain the voluntary protocol standards that still make large parts of the internet work today. The early versions of the IETF's charter say that it represents the internet community. And it did, since at that time most of the internet community was made up of university researchers, industry specialists, or technical enthusiasts and they shared a high level of technical expertise. However, this has changed and now there is a significant gap between those who can build and change the technology and those who can only use it. There is even a bigger gap between those with technological expertise and those who do not use technology or don't know how to use it. As technology spread throughout society, the user community expanded and changed significantly.

Today, however, if there is such a thing as a 'general internet user' it is most likely a teenager with a smartphone who is perhaps a proficient user but not necessarily tech savvy. This expansion of digital technology is the secret sauce of its social and economic success, but it also amounts to one of the information society's greatest challenges – an imbalance in e-skills that risk disrupting the economy, the labor market and the educational system.

ICT is increasingly important to economic growth, not only because of technology-intensive businesses but also because of non-technical enterprises that are harnessing technology to expand, improve or change their business. However, this requires that these companies can find employees with the right set of skills to hire, and when it comes to e-skills this is a growing worry in many countries. Here are some recent trends:

In the essence of creative destruction, the same technological development that creates so many new opportunities also changes the conditions for many current jobs and thus transforms the entire labor market. The problem is that it is not a given that the number of jobs that will vanish is equal to the number of new jobs that will be created. Even if that were the case, the conditions on the labor market and the skills required are changing fundamentally. These effects in turn trickle down to the education system.

EMPOWER THE TEACHERS

While changing conditions in the labor market are affecting the demands on schools and universities, the educational system is also going through a digital transformation of its own. There are a wide variety of programs, reforms and opinions concerning everything from the use of computers or tablets in the classroom to adapted teaching methods and digital learning tools.

Education is a key issue - if not the key issue - in the ongoing digital shift, but too often ICT has been treated as an appendage to the educational system. Schools invested in computers and internet

Demand for ICT skills

According to a report from 2013 by empirica and EXIN on the quality of ICT training, there is excess demand for ICT skills that is not likely to be met in the near or mid-term future. At the same time, interest in ICT education and careers is declining in Europe.

According to the e-Skills Monitor from 2013, Nordic-Baltic countries are predicted to have excess demand for 103,000 ICT workers in 2020, dominated by demand from Sweden and Denmark significantly above the EU average.

At the same time unemployment – youth unemployment in particular, which was at 24 percent at the end of 2013 according to Eurostat – is an increasingly important issue in many European countries. However, IT-specific unemployment has remained significantly lower than total unemployment, even during the recent crisis (e-Skills Manifesto, 2014). This equation doesn't add up.

Many jobs are likely to become redundant as more tasks become automated. According to a study by Deloitte, 35 percent of British jobs will be destroyed during the coming 20 years.

Realizing the huge potential in Data Driven Innovation ("Big Data") requires skills and competences in data analytics: "With data specialists accounting for only 0,5 pct of total employment in most OECD countries, the lack of skills is a barrier" (OECD 4th Global Forum on the Knowledge Economy, Oct 2014)

The ICT industry rates digital skills as European priority no 1. In a recent survey among the member associations of DIGITALEUROPE, "improving the quality of digital skills" was rated as the most important measure on achieving DIGITALEUROPE's vision (2015 DSM Survey Summary, DIGITALEUROPE).

connections during the 1990's and 2000's, and now they invest in tablets and laptops, but this does not automatically result in increased e-skills among students.

In all of this, there is one resource that has been continuously underestimated in most education systems: the teachers. According to a survey from 2013 by European Schoolnet and the University of Liege, students with ICT-confident teachers but with low access to ICT at school still report higher ICT use in education than students with high access to the technology but with low ICT confidence among teachers. On average 30-50 percent of students in fourth and eighth grade in Bulgaria, Estonia, Ireland, Portugal, Slovakia, Slovenia and Sweden have an ICT-confident teacher, whereas less than 10 percent are taught by an ICT-confident teacher in Austria, Belgium, Cyprus, France, Finland, Greece and Luxembourg. Although 50 percent is certainly a lot more than 10 percent, it is still just half of the students at best, and that is far from enough.

Teachers need to be given the tools and skills to include ICT in their teaching, preferably during teacher training programs or at the beginning of their careers, but also through collaboration with other teachers (ICILIS, 2014). Furthermore, ICT and software solutions should be able to aid teachers in administrative tasks and thereby free up time for other things. Still, there is always a risk that reforms will just add to the pile of paperwork and thereby become counterproductive.

To address these issues, teachers and school leaders must be given the right tools, resources and incentives to truly leverage ICTs in the education system. In Britain, schools are currently attempting to tackle these challenges by making programming a mandatory subject in primary and secondary schools in 2014, but the schools are not alone. The Department of Education and a special Computing at School working group have collaborated with organizations like Codecademy to provide a framework from which teachers can adapt the curriculum and their teaching (The Telegraph, *Teaching our children to code: a quiet revolution*). According to the e-Skills Manifesto, computer science is a mandatory subject also in Switzerland.

THINK IN KNOWLEDGE VALUE CHAINS

Much of the school we are familiar with is built to cater to the needs of an industrialized society. If the ongoing transition to an information or knowledge society is believed to be on par with the industrial revolution, maybe we also need to take a step back and reconsider our take on learning, knowledge and education. If there was no school and no education system and we decided to invent it, what would it look like?

Such an undertaking would have to start by looking not at isolated reforms or issues, but at the entire value chain of knowledge: from basic school, to universities or vocational training, continuing onto the labor market through workplace training and executive training, but also through entrepreneurship, venture capitalism, retraining, and validation of foreign qualifications. Rather than dividing skills and knowledge into the institutions where they are taught and grouping them together irrespective of their differences, we differentiate between types of e-skills (or other skills as well) and study their value chain between institutions.

In this spirit, the e-Skills Manifesto 2014 by European Schoolnet argues that the 'educate then work model' is becoming less relevant as the turnover of skills accelerates, markets become more volatile and the linear one-way path from education followed by life-long work will have to be exchanged for an increasingly two-way interaction between learning and working.

The Manifesto introduces the INSEAD skills pyramid to divide e-skills into *literacy and basic skills* at the bottom, *occupational skills* in the middle and *global knowledge economy talents* at the top. The manifesto also states that not only programming skills but e-leadership skills – that is, the combination of ICT skills and leadership skills – will be high in demand in the future. At the same time, the report on quality in ICT training by empirica and EXIN states that although there are thousands of different ICT training certificates to date, they "seem to exist in a parallel universe to that of vocational training and higher education" – that is, without any connection between them. It is not just a question of how isolated parts of the chain work, but of how they fit together, or don't fit together, and how they hold together.

Accordingly, in order to address this type of question, there is a need for dialogue that stretches along the entire knowledge value chain. That in turn requires collaboration as well as joint challenges and goals.

Digital Skills in Europe

According to the Digital Competence framework developed by the European Commission, 23 percent of the population across EU countries in 2012 had no digital skills. The numbers varied significantly, between six percent in Sweden and 50 percent in Romania. Overall, according to the same framework, about half of the EU population is considered to have insufficient digital skills.

In the Digital Agenda for Europe scoreboard for 2014, 39 percent of the European workforce is reported to have insufficient digital skills and 14 percent is reported to have no digital skills at all.

Adequate IT user skills among citizens are increasingly important for society, as demonstrated by e.g. the introduction from 2014 of compulsory Digital Post from public authorities in Denmark, excluding several thousand Danes.

The International Computer and Information literacy Study (ICILIS) from 2014 conclude that many "digital natives" do not have sufficient digital skills, and that school has an important role to fill in finding a solution.

PROMOTE COLLABORATION

Collaboration between education and industry has been a recurring and often unresolved policy issue at many different levels and in many different countries for a long time. However, with respect to knowledge value chains and increased interaction between learning and working, it may be time to re-examine this collaboration, particularly as it concerns higher education.

The 2014 e-Skills Manifesto underlines that countries that suffered least in the recent economic crisis were those that prioritized measures such as apprenticeships and employer engagement in education. Employers should have strong incentives to assist with education, offer real-world problem solving experiences, connect to students and provide much-needed role models to exemplify what a career in ICT might entail.

The Grand Coalition for Digital Jobs

The Grand Coalition for Digital Jobs is a step in this direction. It is a multi-stakeholder partnership between private and public actors in business and education, launched by the European Commission in 2013. The greatest challenge, however, is to make collaboration tangible, to gather good examples and spread them, but also to accumulate knowledge from failures. In addition to being a goal in itself or a motivator for both educators and employers, ICTs might also provide a means to reach goals set. Software solutions could be used to simplify administrative tasks, to improve coordination between teachers and employers and to provide new platforms for collaboration.

The Grand Coalition encourages to establish national coalitions composed of relevant ICT stakeholders to address specific national needs. However, by March 2015 national coalitions are established in only three countries in the Baltic Sea Region – Latvia, Lithuania and Poland. Does this reflect a lack of interest in the other countries?

The typical stereotype of a computer programmer is often at odds with the truth, and it can inhibit young people from exploring a future in an ICT profession. On the other hand, educators should be equally motivated to involve industry in order to include new skills, experience and perspectives that can add to their lessons in a new subject but also motivate students beyond the classroom. However, this requires that institutional barriers - not least in terms of differing rules and regulations or lack of time for teachers to engage in collaboration - be removed and that proper incentives on both ends are promoted.

Baltic Sea Region Information Society Business Academy

Interviews carried out last year among SME's in the Baltic Sea Region show that many SMEs consider it difficult to secure highly specialized skills. An idea could be to establish a cross border education forum, e.g. "Baltic Sea Region Information Society Business Academy". It could organize educational activities for SMEs in BSR in cooperation with universities and private companies, e.g. programs with courses organized in varying countries to which the SMEs can send their employees to gain specific technology skills and business training, learn about the cultural differences, and network with SMEs in the other countries.

(Searching for the Micro-Multinationals, Top of Digital Europe,2014)

THREE E-SKILLS CHALLENGES

The following three points sum up the initial challenges that employers, educators, school leaders and policy-makers need to tackle together:

1 *How can teachers and school leaders get the resources, time and incentives they need to leverage ICTs in education from the bottom up? What indicators for teacher policy and school outcomes could be included in the digital agenda scoreboard?*

2 *What does the knowledge value chain of programming or other e-skills look like? How can educators, employers and policy-makers better engage with knowledge value chains across institutions?*

3 *How can collaborations between industry and education, along knowledge value chains, be simplified, made tangible and be benchmarked? How can we learn from mistakes?*

The growing gap in e-skills across European countries is a serious threat to global competitiveness and future growth, but it is also an opportunity to rethink and reimagine the way we think of knowledge and skill acquisition not just in each country but also across borders.

The Nordic-Baltic countries together constitute an important hotbed with overall high ICT readiness and several promising, vibrant digital entrepreneurship cultures. If they fail to meet the needs for future e-skills, they risk being left behind the competition, but if they succeed they could take the lead globally. What's more, they could do well for themselves on their own, but they would do even better if they succeeded together.

Moving Forward

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The survey results confirms a high potential for collaboration between employers and educators, and a good platform for policy-makers to engage both these groups. In addition, some of the interviewees provided remarks and comments that lead us to summarize the results in three key findings, related to programming in school, programmer skills and knowledge chains, and collaboration between educators and employers.

PROGRAMMING IN SCHOOL SHOULD BE A TOP PRIORITY

Although a majority of the interviewees in the different countries agree that programming should be taught in school, this is not the case in most countries. A close relative to this issue is programming in vocational education.

What is more worrying is that this issue seems to be surprisingly low on the agenda of many policy-makers in the Nordic/Baltic countries, both in education policy and in business policy. Only Finland and Estonia have introduced programming into primary school (Finland's initiative will be implemented beginning in 2016). There is an evident role for policy-makers at a national level to address this issue, and from the looks of it both employers and educators will be able and hopefully willing to provide input to the process.

Policy recommendations

> **National governments should further investigate, evaluate and enable the introduction of programming in school.**

> **Teachers and school leaders should be allotted the resources, time and incentives they need to leverage ICTs in education from the bottom up.**

> **Indicators for teacher policy and school outcomes should be included in the digital agenda scoreboard.**

Questions for further discussion:

What are some good examples to learn from?

Should new teachers learn how to program? Can they?

What is needed in terms of teacher policy, education plans and training programs?

What does experience tell us about the real benefits of learning to code at an early age?

Do the students have sufficient e-skills when they start at university?

Will learning basic coding at an early age benefit the average citizen and foster future ICT specialists?

ICT COMPANIES NEED A WIDE SPECTRUM OF PROGRAMMERS

If the stereotype of the solitary programmer was ever true, it is widely contested today. Solid technical expertise is still in high demand, especially in R&D departments, but overall there is also a need for people who combine programming skills with other skills - entrepreneurship, communication, teamwork, project management, business management, etc.

There is also a need for different types of programming skills. For instance, while some ICT companies emphasize the need for entrepreneurial programmers with leadership or cross-cultural skills, start-ups also want skills in cloud and mobile programming. To some extent, the world seems to be waiting for the millennials who grew up with computers, digitization and code to finish their educations at business school, universities and technical institutes. In total, there is a significant demand for general programming skills that complements rather than substitutes for technical expertise.

Policy recommendations

> **The knowledge value chain of programming or other e-skills should be mapped and monitored.**

> **Educators, employers and policy-makers should better engage with knowledge value chains across institutions.**

Questions for further discussion:

How do teachers, employers, startups, venture capitalists and other actors come together as stakeholders in these e-skills value chains?

How can we cope with the rising need for many different types of programmers?

How can the educational system meet the demand both for technical expertise and a wide range of complementary skills among programmers?

How can mobile app development skills and cloud computing environment skills add to e-skills value chains?

How can we combine the need for quick adaption to the high speed technological development with the need for advanced but "slow" academic knowledge?

WE NEED MORE AND BETTER COLLABORATION

The survey results points to a general level of agreement on these issues between industry and education. However, the level of collaboration between the two does not seem to reflect that impression. This indicates that there are barriers to collaboration, either due to lack of incentive and interest or due to frictions and obstacles that inhibit or prevent such initiatives.

As the need for a new knowledge value chains grows and education plays a larger role throughout careers, this is becoming

an increasingly pressing issue. There are differences in opinions, for instance between universities and startups when it comes to cross-cultural skills. However, these differences should not divide the two, but rather be an incentive for them to complement each other:

Universities should be able to feel that they add something to the quality of education by engaging with employers. Likewise, employers should have incentives to build networks with students and researchers, both for future recruitment and for gaining access to new research and new findings. There is a role for policy-makers to make sure that collaboration makes sense to both parties, and that the equation adds up.

Examples of collaborations and multi-stakeholder partnerships from all over Europe are mapped and showcased in initiatives like the European e-skills monitoring 2013 and the Grand Coalition for Digital Jobs. These initiatives and their results should be benchmarked in order to identify models for direct and successful collaboration between industry and education. In addition, cross-border solutions building on the specific potentials in the Nordic-Baltic Region should be explored.

Policy recommendations

> **Successful models of collaborations between industry and education, along knowledge value chains, should be identified and benchmarked**

Questions for further discussion:

What are the needs at different levels of education? How do they differ and how are they alike? What can we learn from previous experiences of collaboration between educators and employers? What are some good examples?

Can industrial employers in a clear and concrete way define what education profiles make "good" e-skills?

How can we stimulate an early and trustful dialogue?

What are the barriers and drivers for industry-education collaboration? Is it a matter of getting to the table to talk to each other rather than finding a common language?

What can regional, national and European policy-makers do to promote it?

How can we utilize the diversity and the digital competences of the Nordic-Baltic Region, combined with the different approaches between the countries? How can we learn from each other and develop well-functioning cross-border and cross-sector collaboration initiatives?

What's next?

From the ICT Think Tank "Top of Digital Europe" we hope that this discussion paper can stimulate a debate on how experience in Europe in general and the Baltic Sea Region in particular can contribute to meeting the challenges related to demand and supply of e-skills.

It is our intention to facilitate further discussion among key stakeholders on these topics. The aim is to display the diversity and different approaches to e-skills in the Baltic Sea Region and to identify and promote industry-education collaboration models and best practice that successfully combine this diversity with the digital strongholds of the region.

We welcome any input to this discussion.

Sources

The New Digital Age, Schmidt and Cohen, 2013

Searching for the Micro-Multinationals, Top of Digital Europe, 2014

The Computer Boys Take Over, Ensmenger 2010

Digital Agenda Scoreboard 2014 – Digital inclusion and skills in the EU 2014, European Commission

Big Data, Mayer-Schönberger and Cukier, 2013.

Priorities towards a Digital Single Market in the Baltic Sea Region, BDF and BCCA, 2012

European e-skills Monitor 2013, European Commission

e-skills Manifesto 2014, European Schoolnet

Towards a European Quality Label for ICT Industry Training and Certification, empirica & EXIN, 2013

OECD: 4th Global Forum on the Knowledge Economy, briefing note, Oct 2014

The International Computer and Information Literacy Study (ICILS), European Commission, 2014

Survey of Schools: ICT in Education, European Schoolnet, 2013

Teaching our children to code: A quiet revolution, The Telegraph, 4 Nov 2013

Grand Coalition for Digital Jobs, European Commission

2015 DSM Survey Summary, DIGITALEUROPE

A Country snapshot of e-skills in the ***Baltic Sea Region***

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The Baltic Sea Region is considered a frontrunner in the ICT sector and the digital economy. The region continues to attract large foreign investments due to a vast pool of ICT talents, start-ups, and the ability to develop new cutting-edge digital solutions. However, a closer look at the region suggests that developments are quite uneven with some countries (in particular Denmark, Finland, and Sweden) being world leaders while others are lagging behind.

In 2015, the European Commission as part of the digital agenda for Europe launched a new comprehensive index, the so-called DESI Index, the Digital Economy and Society Index to summarize Europe´s digital performance and the development of EU member states in digital competitiveness.

The Digital Economy and Society Index DESI is a composite index aggregating a (weighted) set of relevant indicators structured around five dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital technology, and Digital Public Services. The five dimensions all consist of a range of different sub-indicators. DESI scores range from 0 to 1, a higher score signifies better country performance.

In the DESI Index 2015, the high-performance cluster comprises Denmark, Finland, and Sweden. Estonia is also doing well followed by Germany and Lithuania while both Latvia and Poland are below the EU average according to the DESI Index.

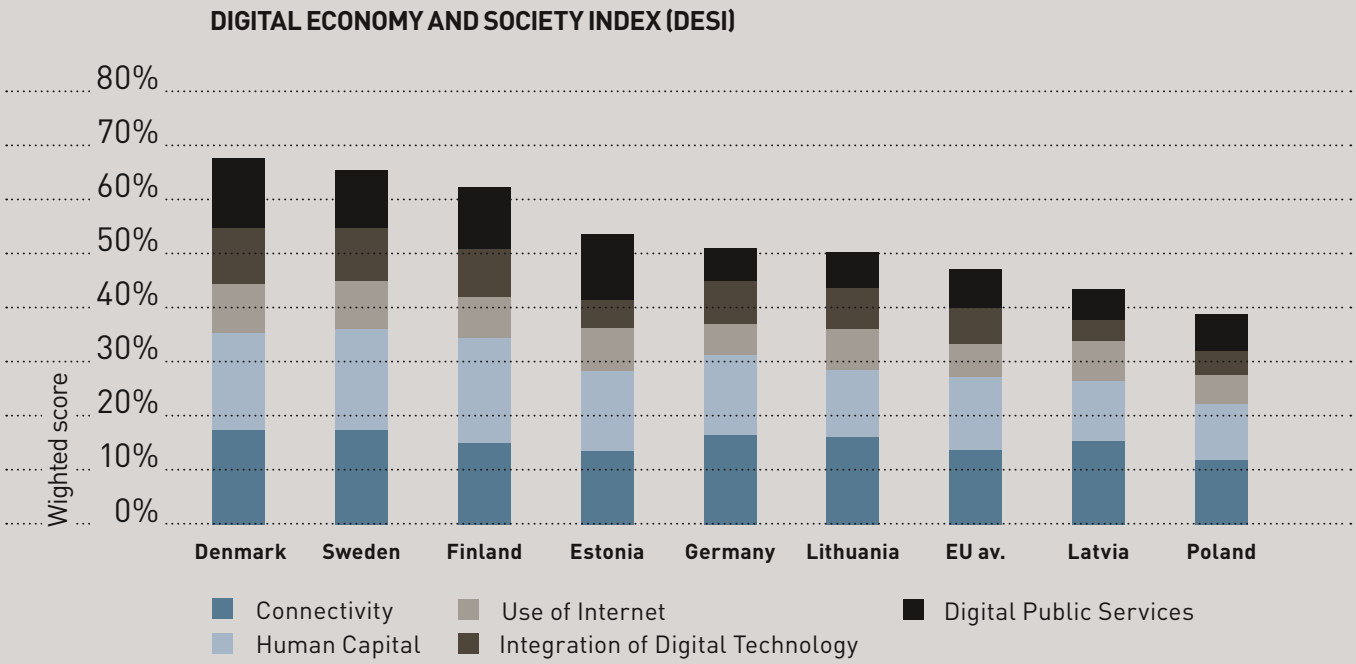
Denmark has an overall score of 0.68 and ranks first out of the 28 EU Member States. Denmark has the most advanced use of digital public services and is also leading on integration of digital technology and the use of internet (with Sweden). Sweden comes in second with the score 0.66 as the lead performer in terms of connectivity and use of internet (with Denmark) and runner-up regarding integration of digital technology. Finland has an overall score 0.62 and ranks fourth among EU countries. Finland is a leader in digital "human capital". Estonia has an overall score of 0.54 and ranks seventh out of the 28 EU Member States. Estonia performs well in the supply and use of digital public services category, making them second best in Europe in that category.

Germany and Lithuania are placed tenth and eleventh respectively in the EU (above the EU average), while Latvia and Poland are both placed below the EU average. More individuals in Latvia become engaged in internet activities. However, according to DESI 2015, Latvia has best improved in terms of "connectivity" (above the EU average), while Poland scores relatively well concerning digital public services and it has succeeded in improving its performance in some areas. Nonetheless, both countries, Poland (0.38) and Latvia (0.43) rank within the cluster of low-performance countries among EU Member States (0.47).

These findings are to a high extent confirmed in other surveys e.g. the World Economic Forum´s Readiness Networked Index, a comprehensive worldwide index with more than fifty different indicators on ICT development. Finland, Sweden, and Norway are all in top 10, with Denmark just outside top 10.

Looking more specifically at e-skills, the DESI Human Capital Dimension gives an indication of ICT skills in the population and in the workforce. The Index is calculated as the weighted average of two sub-dimensions: 2a Basic Skills and Usage (Basic digital skills and internet users), 2b Advanced skills and Development (ICT specialists and STEM graduates (science, technology, engineering and mathematics)).

Finland ranks first among EU countries in terms of Human Capital. In Finland, 90% of the population are regular Internet users and Finland has the highest percentage of users with basic digital skills in the region (79%). Finland also has one of the highest shares of ICT specialists in the workforce (4.7%) of all EU countries. Sweden ranks second among EU Member States. 78% of



the Swedish population have basic digital skills and the number of ICT specialists in the workforce is almost double the EU average (2.8%). Denmark ranks third with the highest number of internet users in the region, high basic digital skills, and a high share of ICT specialists in the workforce. Estonia ranks tenth (above the EU average) with a high percentage of internet users, but the number of STEM (science, technology, engineering and mathematics) graduates is well below the EU average and the lowest in the region. Latvia and Poland are below the EU average on most indicators, while Germany is well above the EU average on most indicators.

E-skills and competences of citizens and employees are important to be able to accommodate the growing need for ICT skills in the workforce and take full advantage of the digital economy. Already today, the excess demand for ICT practitioners is high and is expected to continue to grow significantly in the next five years. According to the "e-skills for jobs" study by the European Commission (2014), Sweden will lack 57,000 ICT practitioners by 2020, while Denmark will have a corresponding excess demand of 27,000. For Finland and Estonia, the figures are 17,000 and 700 respectively.

Overall, the Baltic States as well as Poland and Germany must step up efforts to bridge the gap to the leading countries. While the Nordic countries as the leaders in the EU - and globally - should continue efforts to stay in the top and focus on the development of e-skills, they will increasingly face the challenge of filling ICT vacancies in the future. If the Nordic-Baltic countries do not address this challenge adequately, it may affect their ability to take full advantage of the potential for ICT growth in the coming years.

	DENMARK	SWEDEN	FINLAND	ESTONIA	LITHUANIA	LATVIA	GERMANY	POLAND	EU28
DESI Human Capital Index	0.73	0.75	0.78	0.59	0.5	0.45	0.6	0.43	0.54
Internet Users %individuals (aged 16-74)	92%	91%	90%	82%	69%	72%	82%	63%	75%
Basic Digital Skills %individuals (aged 16-74)	76%	78%	79%	69%	59%	57%	69%	46%	59%
ICT Specialists %employed individuals	4.1%	4.8%	4.7%	3.2%	1.7%	1.7%	3%	2%	2.8%
STEM Graduates Grad. in STEM per 1000 individuals (aged 20-29)	19	16	22	13	23	14	16	18	17

Source: Digital Agenda for Europe, DESI 2015 Country Profiles by European Commission

Executive Summary

Information technology, and with it, programming code is increasingly becoming intertwined with all parts of society. Consequently, understanding basic programming is becoming increasingly important for citizens in order to participate in society and the job market. Code has become a new critical infrastructure and programmers are the ones building it, from mobile games to online banks, business intelligence, and viral marketing. At the same time an intense discussion has developed on the balance between a focus on learning technically specific coding skills versus stimulating broader and more comprehensive e-skills. In this discussion paper, "coding" refers to the general coding discipline, not a specific programming language.

The Nordic and Baltic countries have long claimed an advantage in the emerging information society and economy in part due to widespread internet access and high degree of new technology adoption. However, this advantage may be lost as global competition catches up. If we stagnate, others will outrun us in the information economy. To stay ahead of the curve, the Baltic and Nordic countries need to match their infrastructure and investments with the rising demand for professional e-skills.

This report summarizes some of the challenges educators, employers, and policy-makers face. It presents results from an e-skills survey among startups, leading ICT companies, venture capitalists, and universities in selected Nordic and Baltic countries.

The e-skills survey findings indicate three main tendencies:

There is general agreement between industry and education that coding ought to be taught early in a child's education.

The future looks bright for professionals who manage to combine deep technical e-skills with a collaborative and entrepreneurial mindset.

Industry places more emphasis on new technological developments such as mobile app and cloud computing skills than universities do.

After describing these key tendencies, the report goes on to introduce three general e-skill challenges:

Empowering teachers and school leaders to leverage programming and e-skills in education.

Mapping the knowledge value chains of e-skills.

Promoting and increasing collaboration between educators and employers at all levels of education.

The report then connects these challenges to the survey tendencies in a regional context:

Introducing programming in school should be at the top of the policy agenda. However, in most countries in the region this is not the case.

The demand for programmers is not just growing, it is widening. The need for programming specialists, as well as generalists with complementary skills in business, communications, project management or other fields is on the rise.

The conditions for collaboration between educators and employers appear to be good, but actual collaboration is still lagging behind. This indicates some form of friction or barrier.

Finally, we will set forth a set of key questions to encourage educators, employers and policy-makers to address these issues. How can we introduce programming in school? How do we empower teachers? What does the knowledge value chain for programming skills look like, and how do we improve it? How do we simplify collaboration between industry and education? How can we identify and benchmark the best cross-border and cross-sector initiatives in the region? What can regional, national and European policymakers do to meet digital challenges and seize digital opportunities now and in the future?

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