Chapter 3.

Fostering the digital transformations among individuals, firms and in the government

The use of digital technologies by individuals, firms and the government is a core driver of digital transformation. This chapter presents trends in the uptake of digital technologies in Sweden by individuals by geographic location, age, income and education. It analyses the diffusion of digital technologies among firms as well as the skills that workers need to use such tools effectively. It also examines the use of digital technologies by the public sector and the progress in digital public service and open government data. Finally, the chapter discusses policies to enhance the uptake and use of digital technologies in Sweden and provides policy recommendations.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

The use of digital technologies by individuals, firms and the government is a core driver of the digital transformation. For individuals, digital technologies offer new ways to interact with friends and family, engage with society, and spend and earn. Firms can use digital tools for multiple purposes, ranging from digital market integration to firm reorganisation and data-driven innovation (DDI). Governments and the public sector also leverage digital technologies by making public service delivery more inclusive and effective, building a more efficient data and user-driven digital administration, and fostering economic and societal value creation by opening up government data.

The first section of this chapter presents trends in the uptake of digital technologies by individuals, ranging from simple to more sophisticated Internet uses, by geographic location, age, income and education. It further considers digital security and privacy as barriers to uptake, examines fundamental information-processing and software skills that are needed to use technology effectively, and reviews school performance as an indicator for the acquisition of fundamental skills. Finally, it discusses policies to empower people with the skills that they need to master life in the digital era.

The second section analyses the diffusion of digital technologies among firms as well as the skills that workers need to use such tools effectively. After providing a high-level overview of technology diffusion, it provides a more detailed analysis of the range of uses of digital tools in firms, such as for digital business processes, firm reorganisation and DDI. In relation to different uses, it analyses adequate skills, ranging from generic ICT skills to information and communication technology (ICT) and data specialists and complementary skills. The section finally discusses policies to foster digital technology diffusion among firms, to improve education and training for the skills in demand, and to enhance women's participation in digital occupations.

The third section examines the use of digital technologies by the government and public sector. It focuses on the uptake of digital public services by individuals and businesses, examines progress in opening up government data, and discusses policies to boost both digital public service delivery and open government data. A more comprehensive discussion of these issues can be found in the forthcoming *OECD Digital Government Review of Sweden* (OECD, forthcoming a).

Each section concludes with a summary of the main findings and some policy recommendations.

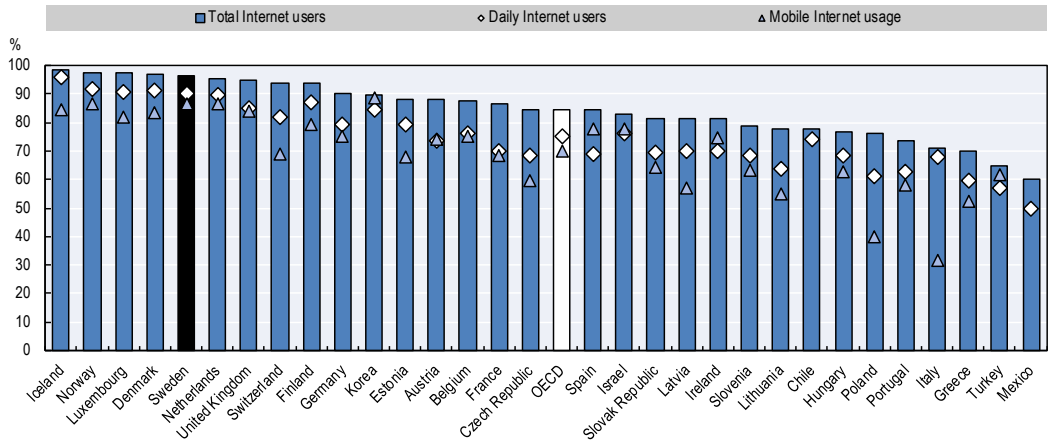
Use of digital technologies and skills among individuals in Sweden

Individuals in Sweden are fast adopters of digital technologies and intensive Internet users

Individuals in Sweden have come a long way in adopting digital technologies, thanks in part to being "technologically skilled and technology-friendly" (Government Offices of Sweden, 2017b). In 2012, computers were used in almost all households and smartphones in just over half of them; five years later, 85% of households had a smartphone and 69% a tablet. Over this period, smartphones have become the primary device for connecting to the Internet. In 2017, the Internet was used by 76% of individuals via their smartphone, by 67% on a computer and by 31% on a tablet (IIS, 2017). Internet usage rates are very high (Figure 3.1), however, 5% of 16-85 year-olds still have never used the Internet and 3% used it over a year ago (information provided by Statistics Sweden).

Figure 3.1. **Internet usage by individuals, 2017**

Percentage of the population



Note: Individuals having used the Internet daily or almost every day over the past three months.

Source: OECD (2018c), *ICT Access and Usage by Households and Individuals* (database), http://oe.cd/hhind.

Most individuals in Sweden not only use the Internet regularly, they also spend an increasing amount of time on line. In 2010, on average, individuals used the Internet 17 hours per week in total, of which 12 hours at home; in 2016, this figure had grown to 24 hours in total and 14 hours at home. On average, 16-25 year-olds spent almost 40 hours while the oldest age group (76+ years) spent only 7 hours per week. Men (16 years and older) spend on average 5 hours more on line per week than women (IIS, 2016). More than nine of the total hours are spent via a mobile phone, which is one hour more than the year before.

Internet usage still varies among different groups of individuals

Important demographic factors that influence Internet usage are age, education, employment and income. The gap between user groups, however, has been decreasing since 2010 (Figure 3.2). The elderly (Panel A) have caught up significantly in sync with retirees (Panel C). Differences between income levels (Panel D) has also decreased, possibly related to lower broadband prices (see Chapter 2). Differences related to education levels (Panel B) have also decreased, but at a slower rate.

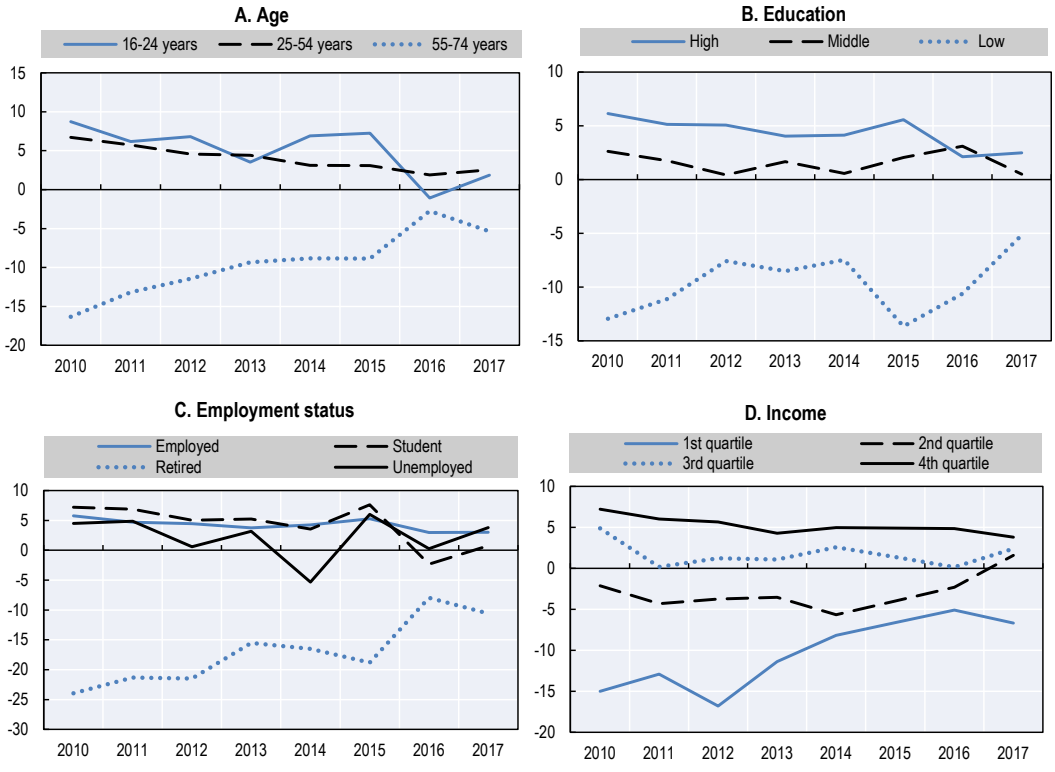
Online activities are well diffused, albeit not all and not everywhere

The Internet is used for a variety of online activities, ranging from simple and well-established uses to newer and more sophisticated ones (Figure 3.3). Sweden ranks above the EU28 average on all activities, although some activities are less common, particularly social networking, content creation, software downloads and online sales.

Lower diffusion of some online activities in Sweden can be partly related to weaker uptake in low population density areas (Figure 3.4). The low uptake of e-government services in sparsely populated areas deserves attention (see below), given the large diffusion of other activities in these areas, e.g. e-mail, e-banking and online purchases.

Figure 3.2. **Key factors influencing Internet usage, 2017**

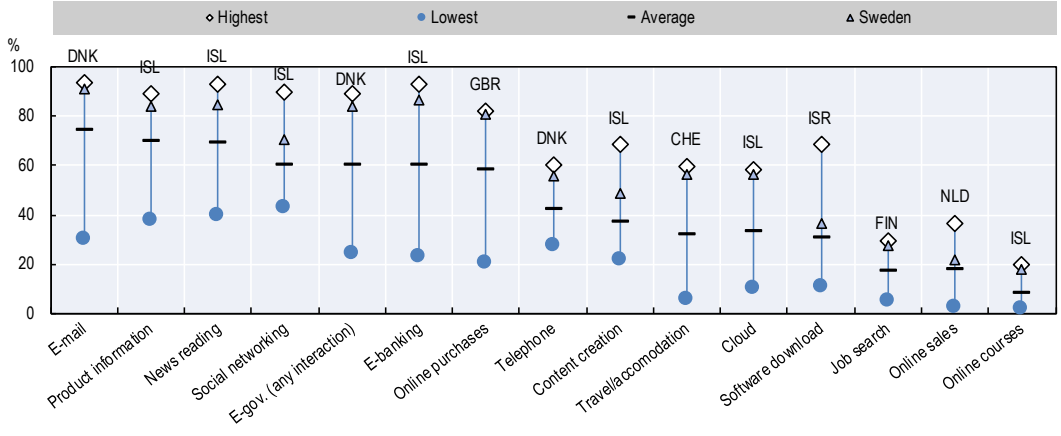
Percentage point difference from average use of all individuals



Source: OECD (2018c), *ICT Access and Usage by Households and Individuals* (database), http://oe.cd/hhind.

Figure 3.3. **Diffusion of selected online activities among Internet users, 2017**

Percentage of Internet users performing each activity

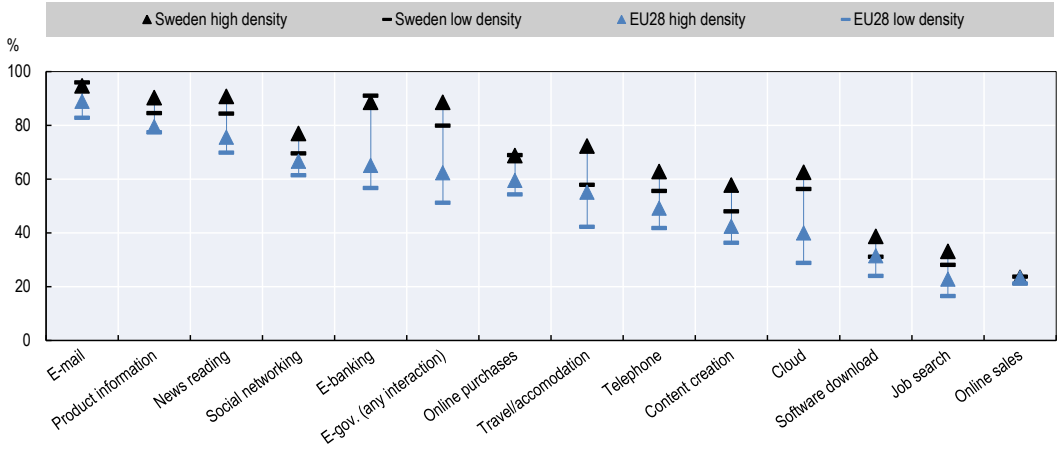


Note: Data for software download refer to 2015.

Source: OECD (2018c), *ICT Access and Usage by Households and Individuals* (database), http://oe.cd/hhind.

Figure 3.4. **Diffusion of selected online activities among Internet users by population density, 2017**

Percentage of Internet users performing each activity



Note: Data on e-government (any interaction) and software download are for 2015.

Source: Eurostat (2018b), *ICT Usage in Households and by Individuals*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

The Internet has become the main source of information and news for many individuals in Sweden. In 2016, for the first time, the Internet was ranked higher as a source of information (3.7 on a scale of 5) than TV (3.5), newspaper (3.2) and radio (3.1) (IIS, 2016). In 2017, Google was mentioned by the majority of individuals (57%) as their main online source of information, followed by Wikipedia (31%) and Facebook (10%) (IIS, 2017).

Uptake is held back by digital security and privacy concerns

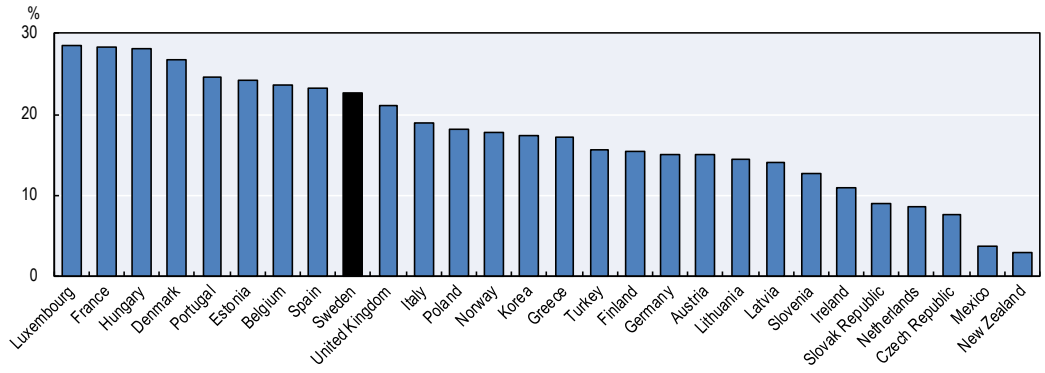
Another pre-condition to engage in digital and online activities is trust. Two key dimensions affecting trust in and the uptake of digital technologies are digital security and privacy. Uptake requires individuals to trust that usage is secure and to be confident that it does not result in giving away personal data without consent.

In many countries digital security incidents experienced by individuals are not an exception. Such incidents may involve, for example, financial fraud, identity theft or personal data breaches and, in most cases, severely affect the trust of the person concerned. The share of individuals having experienced digital security incidents is over 20% in several countries, including in Sweden (Figure 3.5).

With regards to privacy, individuals are increasingly concerned about the collection, storage and use of their personal data and whether they can access and/or control it (OECD, 2017c). These concerns may be an important barrier to usage, keeping many individuals from carrying out certain online activities. Except for online banking, individuals in Sweden are much more likely to refrain from all other online activities due to security and privacy concerns than the average individual in the EU28 (Figure 3.6). Security and privacy concerns keep close to 50% of individuals from providing personal information for social and professional networking.

Figure 3.5. **Individuals having experienced digital security incidents, 2015 or later**

Percentage of individuals

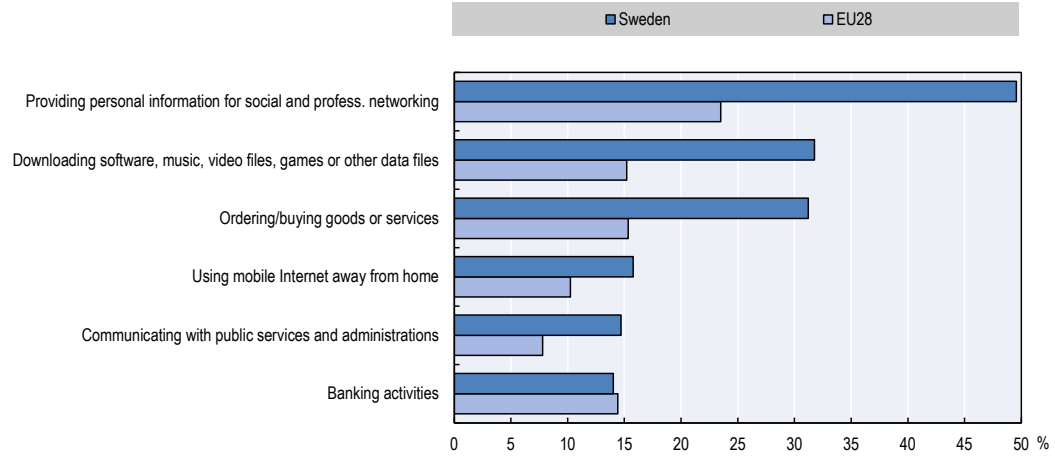


Note: Data for Korea refer to 2016 for all individuals but the breakdown by level of educational attainment refers to 2014. Data for New Zealand and Switzerland refer to 2014. Data for Iceland refer to 2010. Data for Korea, Mexico, New Zealand and Switzerland follow a different methodology.

Source: OECD (2017c), *OECD Digital Economy Outlook 2017*, http://dx.doi.org/10.1787/9789264276284-en.

Figure 3.6. **Security and privacy concerns keeping individuals from carrying out online activities, 2015**

Percentage of individuals



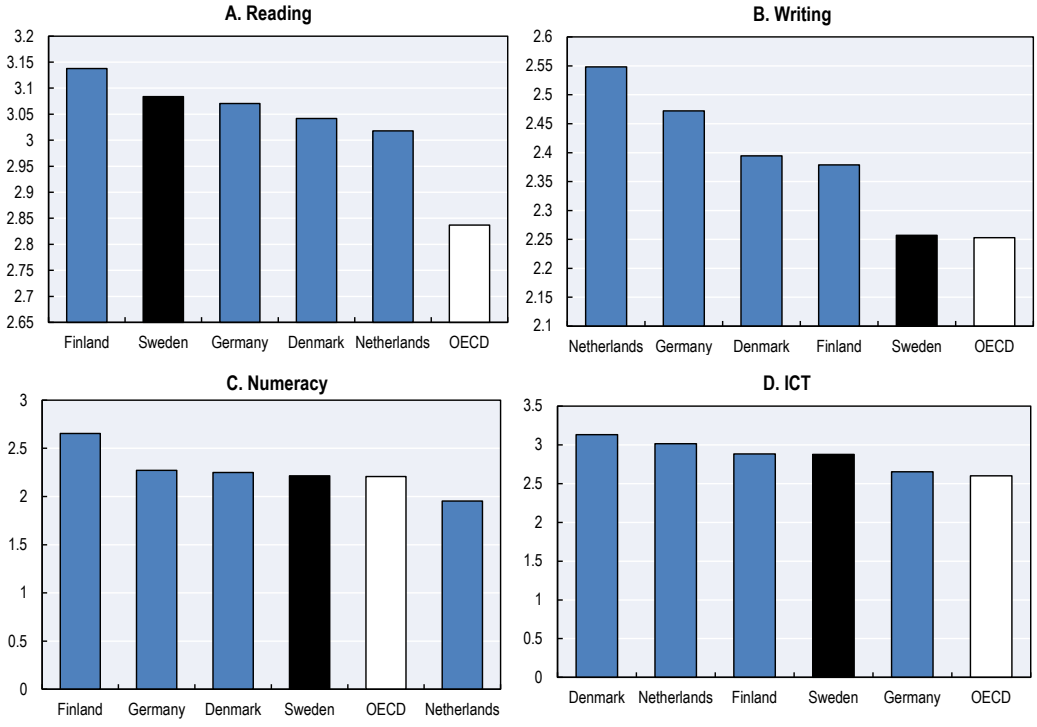
Source: Eurostat (2018b), *ICT Usage in Households and by Individuals*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

Some important skills and school performance have room for improvement

In order to fully participate in digital life and society, individuals need the right skills. Compared to the OECD average (10%), Sweden has a low share of adults with no computer experience (1.6%) (OECD, 2016d) However, some information-processing skills are used less frequently in Sweden than in other comparable countries (Figure 3.7). The frequency of use of writing and numeracy skills is close to the OECD average while the frequency of use of ICT skills is lower than in the Netherlands, Germany and Denmark.

Figure 3.7. **Information-processing skills used in everyday life, 2015**

Average use from 1 "never" to 5 "every day"

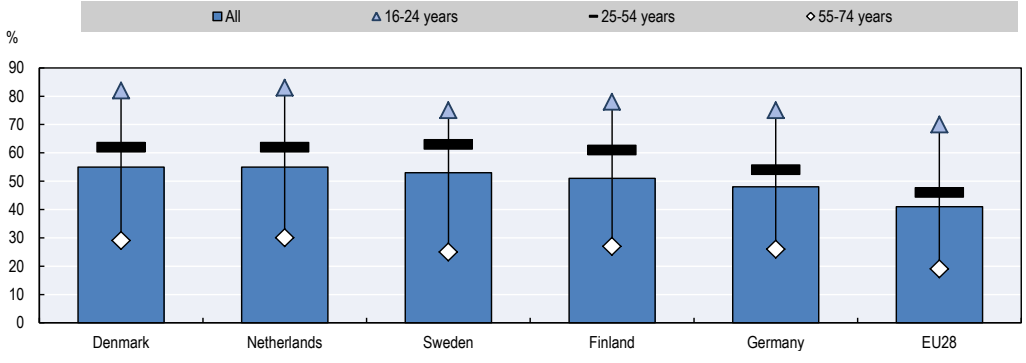


Source: OECD (2017e), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis/#d.en.408927.

On advanced (above basic) software skills, Sweden performs in the midfield of its comparable countries for the share of all individuals (Figure 3.8); however, the shares of young (16-24 years) and elderly (54-74 years) with advanced software skills are only just above the EU28 average.

Figure 3.8. **Advanced software skills, 2017**

Percentage of individuals by age



Note: Individuals with advanced (above basic) software skills, as measured in this indicator, performed at least one of the following activities: created a presentation or document integrating text, pictures, tables or charts; used advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts); have written a code in a programming language.

Source: Eurostat (2018b), *ICT Usage in Households and by Individuals*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

The mixed picture on skills presented above might partly be related to school performance. Over the past decade, the school performance of 15-year-olds, as measured in the Program for International Student Assessment (PISA), has declined in Sweden. From a position well above average in all subjects in 2000 and 2003, Sweden was for the first time below average in all subjects in 2012, ranking 25th of 34 in both mathematics and science and 19th in reading. This trend is confirmed by the results of other international surveys (e.g. Progress in International Reading Literacy Study, Trends in International Mathematics and Science Study) and is consistent with the weaker results of the younger cohorts of Swedish adults in the Programme for the International Assessment of Adult Competencies (PIAAC) Survey (OECD, 2013). While the negative trend in school performance has slowed down over recent years and might have reversed in some areas, performance levels still remain lower than a decade ago.

Policies need to empower everyone with the skills required to succeed in a digital era

Reviewing school reforms to improve the acquisition of fundamental skills

Sweden's Digital Strategy aims to ensure that "everyone will be able to develop and use his/her digital skills" (Government Offices of Sweden, 2017b). The Digital Strategy recognises the important role of the school system in providing all children and students with the skills needed to actively participate in an increasingly digital life and world of work. The strategy also notes that digital literacy includes media and information literacy, such as the knowledge and skills needed to find, analyse, evaluate, and create information in different media and contexts.

Several school reforms have been carried out over the past decade to address Sweden's declining school performance (see below), including reforms aimed at improving digital skills. For example, the 2010 Education Act updated regulations for all levels of education, including pre-school, upper secondary school, the Sámi school and municipal adult education. Focusing on teacher qualifications, the "Boosting the teaching profession" programme (Lärarlyftet), introduced in 2007 and still in place today, provides continuous teacher training, including for mathematics and reading skills. Among different methods being tried to improve writing and numeracy skills, experiments with the "Writing to Learning" method, implemented in several public schools, seem to be successful in making innovative use of digital technologies among teachers and students to improve learning results (Box 3.1).

A key barrier to improving school performance is the low reputation and attractiveness of becoming a teacher in Sweden, already pointed out earlier by the OECD. The ageing teacher cohort shows that not enough students are being attracted to the profession, due, among others, to low economic incentives and limited career progression. In addition, many teachers perceive administrative work they have to carry out as affecting their capacity to deliver high-quality teaching (OECD, 2016a).

The main measure to address this barrier is the "Boosting the teaching profession" programme. This programme includes several suggested actions to be implemented over the course of 2018 to increase the attractiveness of the teaching profession and to improve continuous training offers for teachers: investments of EUR 25.5 million until 2021 to facilitate the uptake of the teaching profession; more places in complementary education programmes and summer courses for teachers; re-prioritisation of funding to teacher training and supplementary education; as well as a strengthening and extension of the "Boost for Teachers" programme with additional funds (MER, 2017b).

Box 3.1. The Writing to Learning method

Writing to Learning (WTL) is an innovative method for integrating ICTs in education. Its overall goal is to leverage the use of digital technology in schools to improve literacy and numeracy skills and to close the gender gap among young students. It involves formative feedback and assessment among students as well as between students and teachers.

The WTL was developed in 2011 and has been tested over several years. A recent assessment of the programme found positive effects. Based on 502 students from 21 classes taught by 23 teachers in 11 public schools in one Swedish city, the assessment included students that passed 8 literacy and 7 numeracy tests. A clear difference was found for both skills between the group of students that used the WTL method compared to the group of students that used a traditional method. For literacy, 92% of students in the WTL group passed all eight tests, compared to 79% of students in the traditional group. For numeracy, 81% passed all seven tests compared to 65% in the traditional group. The use of the WTL method also reduced the gender gap in both literacy and numeracy.

Source: Genlott and Grönlund (2016), "Closing the gaps: Improving literacy and mathematics by ICT-enhanced collaboration", http://dx.doi.org/10.1016/j.compedu.2016.04.004.

More specifically directed at digital skills, a recent reform of curricula and syllabuses in compulsory and upper secondary schools aims at strengthening both programming skills and more general digital and media literacy. This reform: i) introduced programming, especially in engineering and mathematics courses; ii) increased work with digital texts, media and tools to strengthen students' ability to critically evaluate sources; iii) strengthened the teaching of problem-solving skills and of the ability to creatively translate ideas into action using digital technology; and iv) increased the use of digital systems and services in school to foster a better understanding of the impact of digitisation on individuals and society. School principals are requested to implement the reforms within one year from July 2017 (MER, 2017c).

Additional proposed measures for implementation in 2018 include:

- A **read, write, count guarantee**, which would consist of obligatory precautionary measures in primary and lower secondary schools, compulsory schools and special schools for students that need support. Based on an assessment of a student's linguistic and mathematical capabilities, special support will have to be provided to that student in case he/she is not capable of fulfilling minimum requirements. This measure would be implemented through an amendment of the 2010 School Act (COL, 2017a).
- **Compulsory pre-school class** for all children residing in Sweden. Children would enter school one year earlier than today, in the autumn term of the calendar year when the child is six. The school duty in Sweden would thus be extended by one year to ten years. This reform should strengthen the responsibility to prepare children for grade one and be a bridge between pre-school and elementary school. This measure would be implemented through an amendment of the 2010 School Act (COL, 2017b).

Developing digital literacy through better use of digital technologies in schools

Following recent reforms of curricula to better reflect the need for generic ICT skills, and complementing the overarching Digital Strategy, in October 2017 the Ministry of

Education and Research published the National Digitalisation Strategy for the School System. This strategy provides a more comprehensive approach to digital skill development, access to and use of digital technologies, and research and monitoring of digital opportunities for schools (Box 3.2). In a first step to implement the strategy, the central government, together with the Swedish Association of Local Authorities and Regions (SKL in Swedish), is developing concrete initiatives and activities under each objective of the strategy.

Box 3.2. **National Digitalisation Strategy for the School System**

The National Digitalisation Strategy for the School System focuses on three main areas, within each of which it aims to achieve several objectives by 2022.

1. Digital literacy for everyone in the school system

Objectives:

- all students in Sweden's schools have the opportunity to develop appropriate digital skills
- pre-school managers and school principals should have the ability to strategically lead digital developments
- staff working with children and students should have the skills to choose and use appropriate digital tools in education.

2. Equal access and use

Objectives:

- children, students and staff who work with children and students have access to digital tools based on their needs and circumstances
- adequate infrastructure and technical and educational support are operational
- digital learning resources used in teaching should be appropriate and enable effective use of technologies
- digitalisation will be used to facilitate education and the administration staff's working environment.

3. Research and monitoring of digitisation opportunities

Objectives:

- research on the impact of digitalisation on teaching and learning and support for the development of relevant actions
- follow-up to digitalisation in the school system and support the development of relevant initiatives.

The government is currently working together with the SKL on developing activities under each of the strategy's sub-goals.

Source: MER (2017a), "Nationell digitaliseringsstrategi för skolväsendet", www.regeringen.se/4a9d9a/contentassets/00b3d9118b0144f6bb95302f3e08d11c/nationell-digitaliseringsstrategi-for-skolvasendet.pdf.

Recommendations

This section shows that overall uptake of digital technologies among individuals is well advanced, but also reveals remaining gaps in usage among different groups of individuals, different types of uses and different territories. It further shows that security and privacy concerns are holding back the uptake of certain online activities, and that some important skills and school performance have the potential to be improved. The government may thus consider:

1. **Fostering digital inclusion through policies targeted to groups with lower usage levels of digital technologies,** notably among those in sparsely populated areas and individuals with low levels of education and income, as well as the elderly, retirees and people with special needs. It could also consider measures to enhance trust in digital technologies by addressing individuals' security and privacy concerns.
2. **Empowering people through policies that improve individuals' fundamental skills and digital literacy**, notably writing and numeracy skills and generic ICT skills. Continue reform efforts to improve school performance, increase the attractiveness of the teaching profession, and support effective use of digital tools in schools. Consider creating a comprehensive digital skills strategy (see below).

Diffusion of digital tools and skills among Swedish firms

Despite good performance overall, weaknesses remain in important areas

The use of digital tools is an essential condition for firms to thrive in the digital economy and most of such tools are widely diffused among firms in Sweden (Figure 3.9). Almost all firms have a broadband connection and a website and many use social media. The share of firms using more advanced digital tools (e.g. cloud computing, ERP, e-sales and customer relationship management) is also above the OECD average. However, some important tools such as e-purchases, supply chain management and big data analysis (BDA) are used by fewer firms in Sweden than on average in the OECD. A significant gap also remains between large and small firms for all advanced digital tools, in particular for customer relationship management, cloud computing, social media, e-sales and big data, although small and medium enterprises (SMEs) are expected to benefit more from these tools.

Key digital tools are widely used, but there is room for improvement

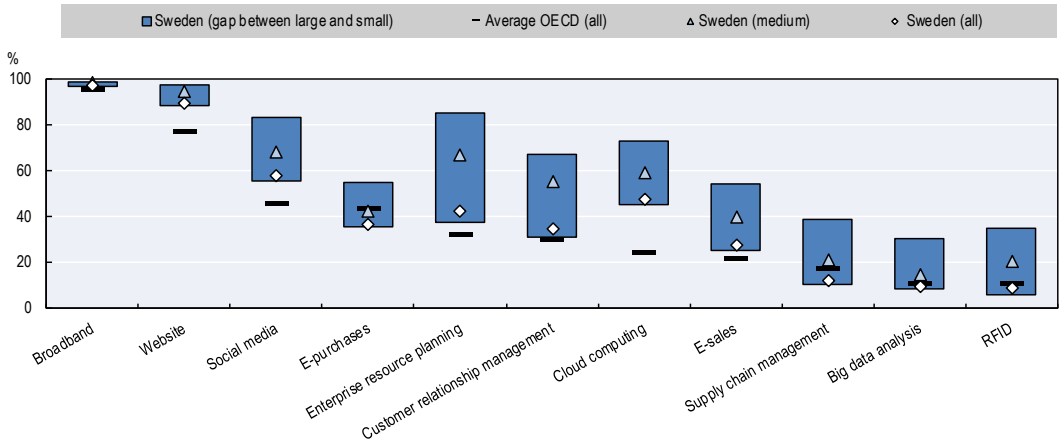
A basic condition for firms to participate in the digital economy is access to a broadband connection. Once connected, most firms not only create a website to be visible or to sell on line but many also use social media to promote their brand and products and to communicate directly to and with consumers. Such tools can be considered as basic digital tools. Basic digital tools are used by a large share of firms in Sweden, ahead of the EU28. However, European countries are following suit with higher usage growth (Figure 3.10). SMEs are also catching up, with higher usage growth between 2012 and 2017 than that for large firms.

A next step for many firms is digital market integration. Measured by the share of firms placing and receiving orders over computer networks, more firms in Sweden are digitally integrated into markets than in the EU28. However, European countries are catching up with higher average usage growth than Sweden between 2012 and 2017 (Figure 3.10). Surprisingly, digital market integration increased among small firms, but decreased among large firms. A factor that may support digital market integration in Sweden

is the country's dynamically evolving digital payment ecosystem, which includes partnerships between fin-tech start-ups and established banks.

Figure 3.9. **Diffusion of selected digital tools in firms, 2016**

Percentage of all firms, by firm size

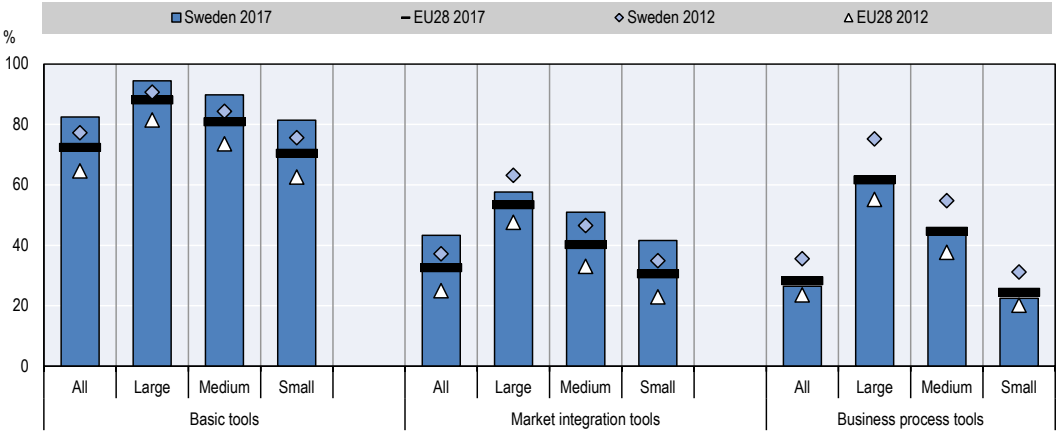


Notes: RFID = radio frequency identification. Large firms = 250 employees and more; medium firms = 50-249 employees; small firms = 10-49 employees. For more details, see Endnote 1.

Source: OECD (2018d), *ICT Access and Usage by Businesses* (database), http://oe.cd/bus.

Figure 3.10. **Key digital tools used by firms**

Percentage of non-financial firms, by firm size



Note: See details in Endnote 2.

Source: OECD (2018d), *ICT Access and Usage by Businesses* (database), http://oe.cd/bus.

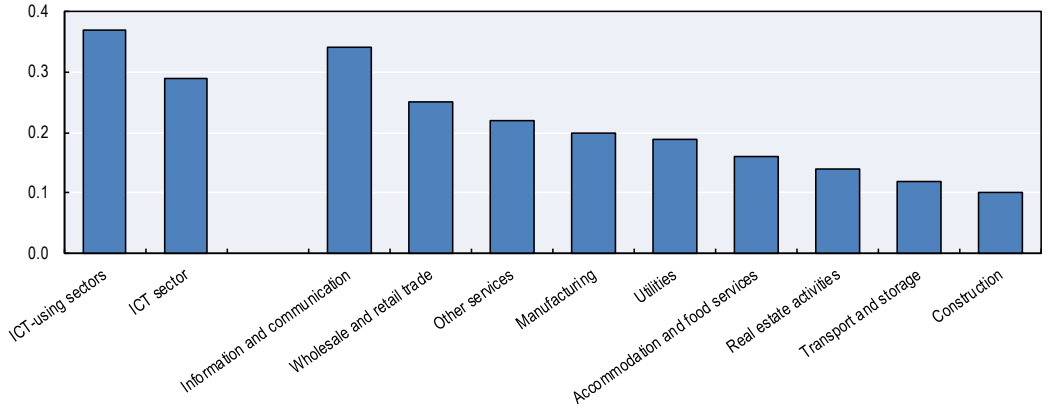
Digital tools also play a key role in making business processes more efficient, both internal firm processes as well as exchanges with suppliers and customers. The extent to which business processes are becoming digital can be measured by the use of software for ERP, customer relationship management and supply chain management. Sweden was an early adopter of these tools, but usage declined significantly between 2012 and 2017. Over the same period, average usage in the EU28 increased to being slightly above

Sweden's usage today (Figure 3.10). One explanation for the negative trend in Sweden could be that more and more firms tend to outsource ICT functions and are moving to a next generation of business process software that can be provided as a service over the cloud. This would be in line with high uptake of external ICT services and cloud computing for advanced applications (see below).

Firms' digital maturity varies significantly by sector (Figure 3.11). ICT-using sectors and the ICT sector are the most digitally mature, followed by comparatively high digital maturity of wholesale and retail trade, other services, and manufacturing. Construction, real estate and transport are the least mature.

Figure 3.11. **Digital maturity by sector, 2014**

Digital maturity index



Notes: ICT = information and communication technology. This digital maturity index takes into account firms' use of social media, e-invoices, e-sales, ERP, customer resource management and supply chain management. See source for further details.

Source: Growth Analysis (2017), "Factors affecting the establishment of a testbed: An analysis of Vinnova's 'Environmental Technology Testbeds' program", www.tillvaxtanalys.se/in-english/publications/pm/pm/2017-12-22-factors-affecting-the-establishment-of-a-testbed----an-analysis-of-vinnovas-environmental-technology-testbeds-program.html.

Strong diffusion of digital business organisation tools is matched by high investment in knowledge-based capital

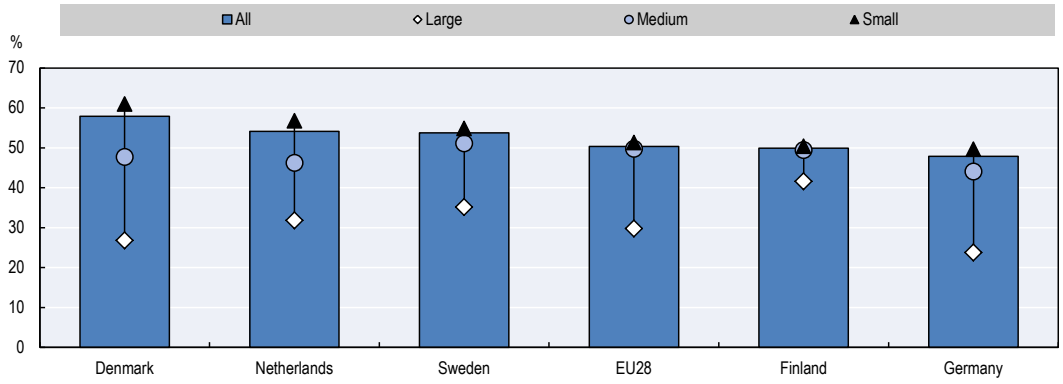
Digital tools also allow firms to reorganise and adopt new business models, which can increase productivity and create new value. Indeed, intensive users of such digital tools, for example ICT service firms, tend to be more productive than other firms (Andrews, Criscuolo and Gal, 2016). But more traditional firms, for example in manufacturing, can leverage external services for ICT functions, including cloud computing, to reallocate resources, e.g. by shifting capital to operating expenditures. For example, tapping into opportunities of the "industrial Internet", General Electric is an intensive user of cloud computing for connecting jet engines, power plants and hospitals (Egan, 2016).

Two important tools that power digital business organisation and new business models are the outsourcing of ICT functions and cloud computing. Sweden ranks above the EU28 average for the share of firms that outsource their ICT functions to an external supplier, with the largest share among comparable countries of medium-sized firms and the second largest share of large firms that outsource ICT functions (Figure 3.12).

In addition to good uptake of ICT outsourcing, cloud computing for advanced applications is widely diffused in Sweden. On average, twice as many firms in Sweden use cloud computing for advanced applications than in the EU28. The dynamic uptake in Sweden is driven to an important extent by large firms as well as by the ICT sector and professional, scientific and technical activities (Figure 3.13).

Figure 3.12. **Outsourcing of ICT functions, 2017**

Percentage of non-financial firms, by firm size

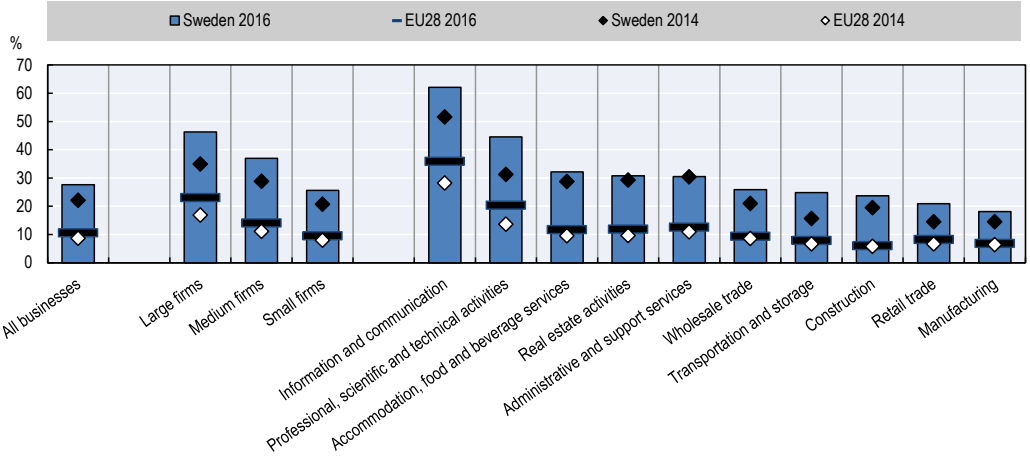


Note: Share of firms in which ICT functions are mainly performed by external suppliers.

Source: Eurostat (2018a), *ICT Usage in Enterprises*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

Figure 3.13. **Firms using cloud computing for advanced applications**

Percentage of non-financial firms, by firm size and sector



Note: Wholesale and retail trade do not include motor vehicles and motorcycles.

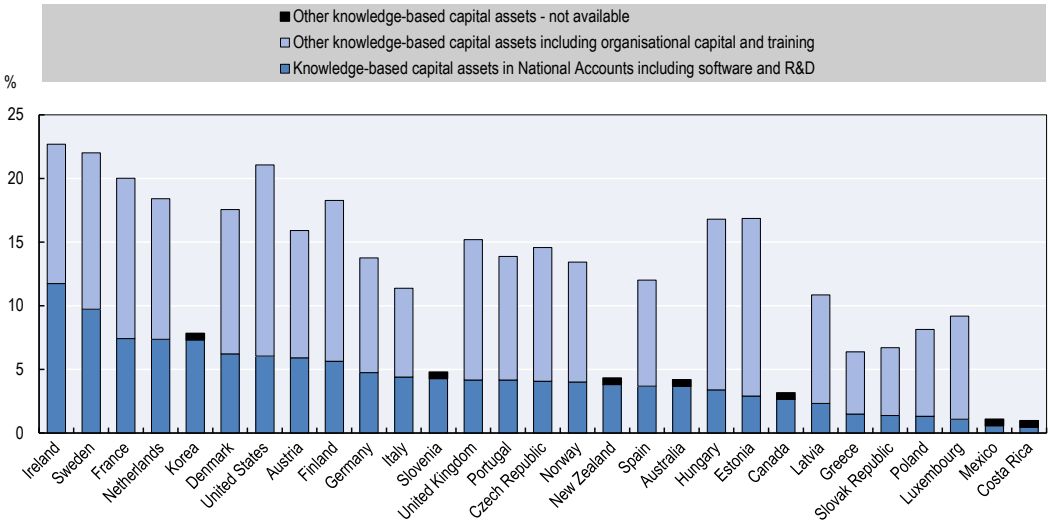
Source: OECD (2018d), *ICT Access and Usage by Businesses* (database), http://oe.cd/bus.

Digitally enabled business organisation and models often require complementary investments in knowledge-based capital, e.g. including software, research and development (R&D), intellectual property, design, and brands (Andrews and Criscuolo, 2013), and most notably organisational capital and management practices (OECD, 2016b). In line with

wide diffusion of digital business organisation tools, business investment in knowledge-based capital is high in Sweden, compared to other OECD countries (Figure 3.14).

Figure 3.14. **Business investment in knowledge-based capital, 2015**

Percentage of business sectors' gross value added



Notes: R& D = research and development. Data, in current prices, refer to the private market sector and follow the definition of INTAN-Invest, i.e. ISIC Rev.4 Divisions 01 to 82 excluding 68 and 72. Intensities are defined as investment over gross value added as sourced from the OECD *System of National Accounts (SNA) Database*. Knowledge-based capital assets in National Accounts are sourced from the *SNA Database* and correspond to the Intellectual Property GFCF. R&D investment by sector for the United States is sourced from the US Bureau of Economic Analysis. Data on other knowledge-based capital assets are sourced from INTAN-Invest and extrapolated, where necessary, using the growth rate of Intellectual Property GFCF from the OECD *SNA Database*. "Other knowledge-based capital assets" include design, new financial products, brands, training and organisational capital.

Sources: Author's calculations based on OECD (2017c), *OECD Science, Technology and Industry Scoreboard 2017: The Digital Transformation*, http://dx.doi.org/10.1787/9789264268821-en; *Annual National Accounts Database*, www.oecd.org/std/na; INTAN-Invest data, www.intan-invest.net; and US Bureau of Economic Analysis data, May 2017.

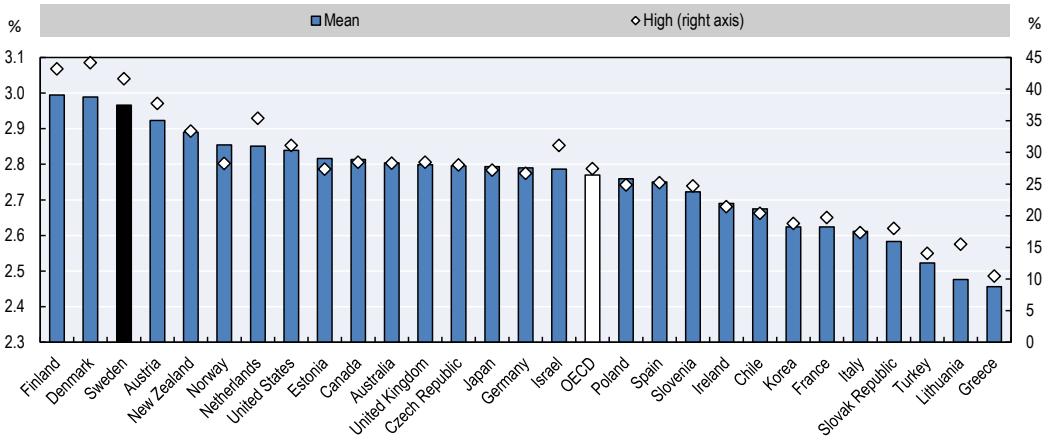
Organisation capital and management practices are measured by the OECD's High-performance Work Practices (HPWP) Index, which covers work organisation skills and characteristics such as team work, autonomy, task discretion, mentoring, job rotation and applying new learning, as well as management practices including bonus payments, training and flexible working hours. Resonating with the findings above, Sweden also performs high on the HPWP Index (Figure 3.15).

Weak diffusion of big data analysis may thwart data-driven innovation

Innovation is increasingly driven by the use of digital tools and notably by analysis of large datasets. Digital and DDI enables the development of new products, processes, organisational methods, and markets and the improvement of existing ones. DDI can also add value to existing products, for example through data-driven services that complement manufactured goods. As noted by Sweden's Digitalisation Commission, DDI is important for firms to stay competitive against new entrants with data-driven products and business models, such as widely witnessed over the past decade in sectors such as media, publishing, banking, transportation or accommodation (DK, 2015a).

Figure 3.15. **High-performance work practices: Work organisation and management practices**

Percentage of jobs with high HPWP and mean HPWP score, by country



Notes: HPWP: high-performance work practices. This figure reports the mean value of the HPWP indicator and the percentage of individuals in jobs with high HPWP (>p75). The HPWP Index is obtained by summing the scales of all subcomponents as described in OECD (2016d).

Source: OECD (2016d), *Skills Matter: Further Results from the Survey of Adult Skills*, http://dx.doi.org/10.1787/9789264258051-en.

BDA is essential to unleash DDI in firms, and Sweden clearly lags behind in the share of firms using BDA. Uptake is not only sluggish across most sectors, but in particular among medium-sized and small firms (Figure 3.16). In turn, much BDA capacity may be concentrated in fewer large firms and well-performing sectors. The comparatively low share of firms using BDA in the ICT sector is particularly unsettling given the importance of the sector for the Swedish economy and its role as an early adopter and innovator (Vinnova, 2015; OECD, 2017c). Uptake is particularly low for firms that perform BDA with their own employees (Figure 3.17B), while being somewhat higher for firms that perform BDA with an external service provider (Figure 3.17C). This resonates with the strong tendency of Swedish firms to outsource ICT functions and to use cloud computing (see Figures 3.12 and 3.13 above).

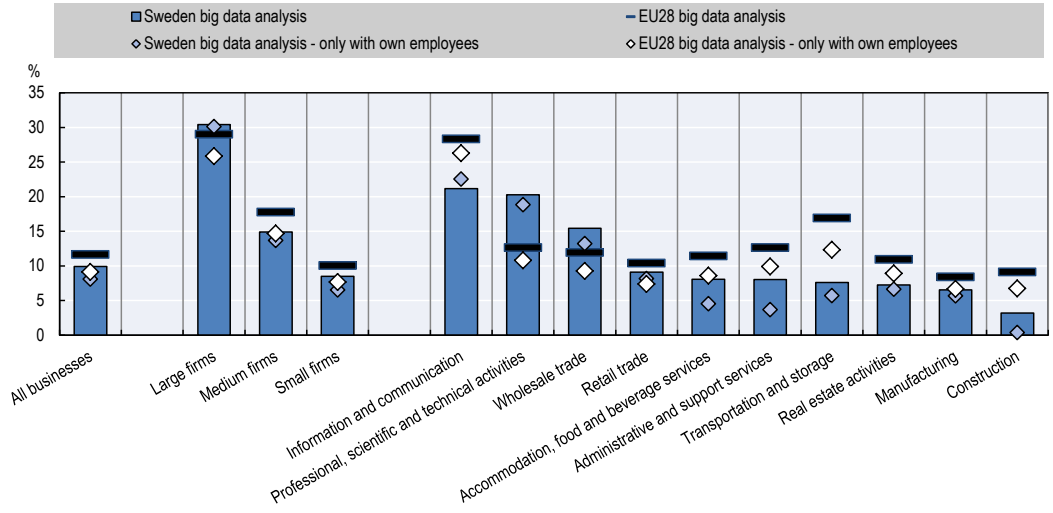
Despite good basic digital skills, demand for ICT and data specialists outstrips supply

For digital tools to improve firms' productivity, workers need adequate skills to use these tools effectively. A foundational skill needed for effective use of digital tools is problem-solving proficiency in technology-rich environments, defined as "using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks". While Sweden performs well on problem-solving proficiency in technology-rich environments, there is still a high share of the elderly (55-65 year-olds) that do not have any computer experience at all or that failed the ICT core test of the OECD Survey of Adult Skills (Figure 3.18).

The use of key digital tools requires ICT skills. In line with good diffusion of most of these tools, ICT skills are widely used at work in Sweden, ranking above the OECD average. However, the comparable countries of Denmark, the Netherlands and Finland are ahead of Sweden (Figure 3.19).

Figure 3.16. **Firms performing big data analysis, 2016**

Percentage of non-financial firms, by firm size and sector

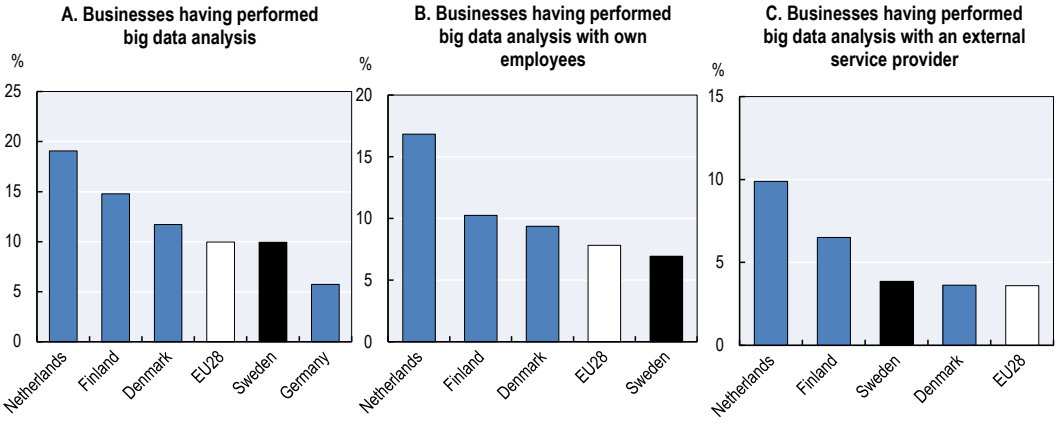


Note: Wholesale and retail trade do not include motor vehicles and motorcycles.

Source: OECD (2018d), *ICT Access and Usage by Businesses* (database), http://oe.cd/bus.

Figure 3.17. **Firms performing big data analysis with own employees and external service providers, 2016**

Percentage of non-financial firms



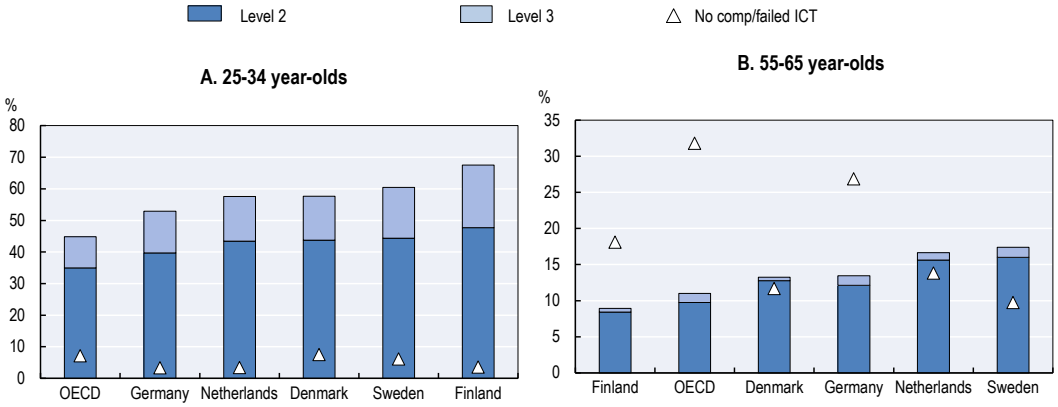
Note: For Germany (DEU) no data available for Panels B or C.

Sources: Eurostat (2018a), *ICT Usage in Enterprises*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

Widespread diffusion of digital business organisation tools in Sweden is matched by a high share of ICT specialists, in particular ICT professionals and ICT service managers employed across the economy (Figure 3.20). These professionals are important to effectively implement tools such as advanced cloud computing applications.

Figure 3.18. **Problem-solving proficiency in technology-rich environments, 2015**

Percentage of adults scoring at Level 2 or 3 in digital problem solving or having no computer experience

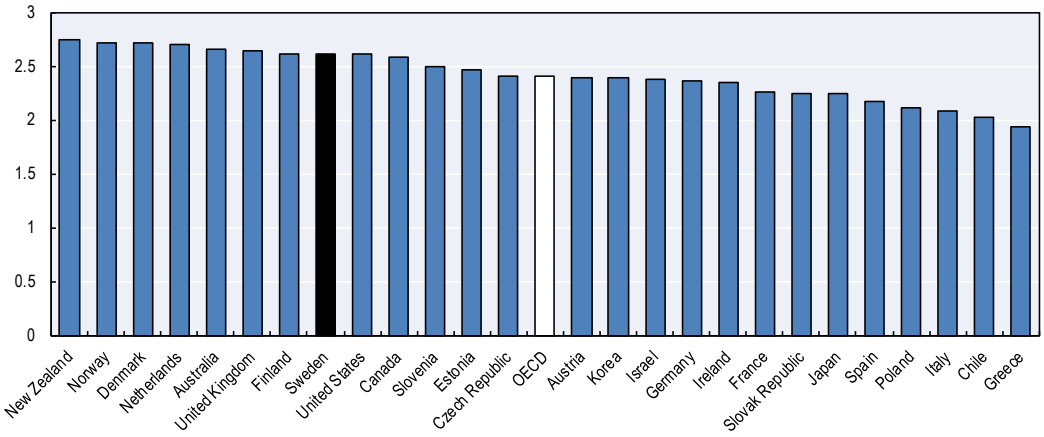


Notes: ICT = information and communication technology. The OECD Survey of Adult Skills defines problem solving in technology-rich environments as "using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks". Adults in the category "no comp/failed ICT" either had no prior computer experience or had prior computer experience but failed the ICT core test, which assesses the basic ICT skills, such as the capacity to use a mouse or scroll through a webpage, needed to take the computer-based assessment.

Source: OECD (2016d), *Skills Matter: Further Results from the Survey of Adult Skills*, http://dx.doi.org/10.1787/9789264258051-en.

Figure 3.19. **ICT skills used at work, 2015**

Average use from 1 (never) to 5 (every day), working population aged 16-65

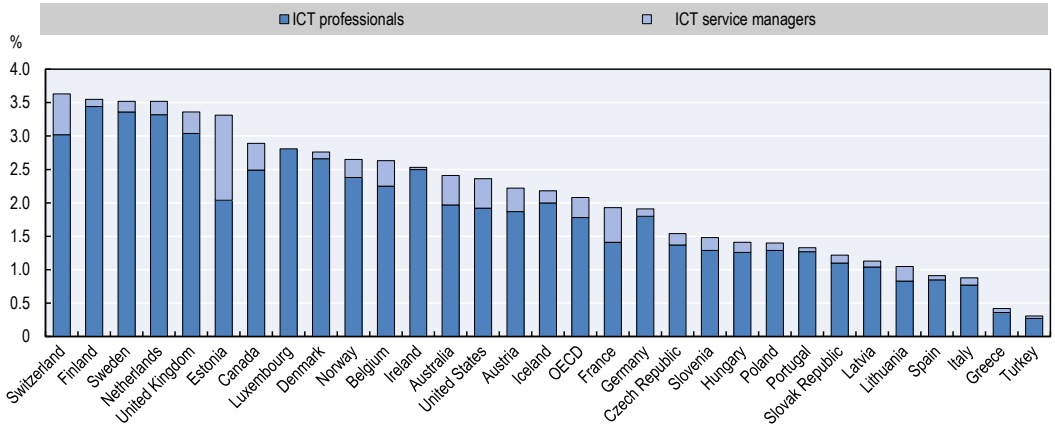


Source: OECD (2016d), *Skills Matter: Further Results from the Survey of Adult Skills*, http://dx.doi.org/10.1787/9789264258051-en.

The strong demand for ICT specialists in Sweden, as indicated in Figure 3.20, is not met by strong supply of related skills. Sweden's share of tertiary graduates in ICTs as a share of all tertiary graduates is below the OECD average (Figure 3.21).

Figure 3.20. **Employment of selected ICT specialists, 2016**

Percentage of total employment, by category

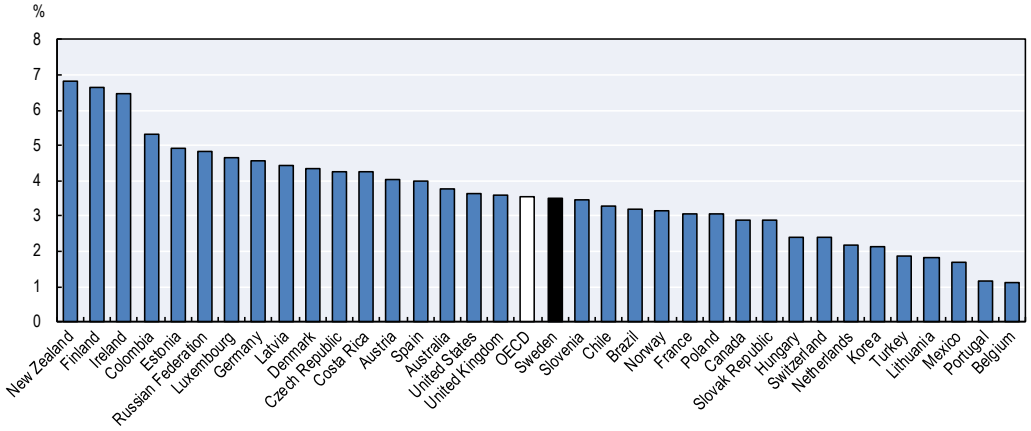


Notes: ICT = information and communication technology. ICT service managers and professionals and ICT professionals correspond to ISCO-08 group 133 and 25, respectively. The OECD aggregate is a weighted average for all countries for which data are available. Data for Canada and the United States refer to 2015.

Source: Based on OECD (2017c), *OECD Digital Economy Outlook 2017*, http://dx.doi.org/10.1787/9789264276284-en.

Figure 3.21. **Tertiary graduates in ICT, 2015**

Percentage of all tertiary graduates



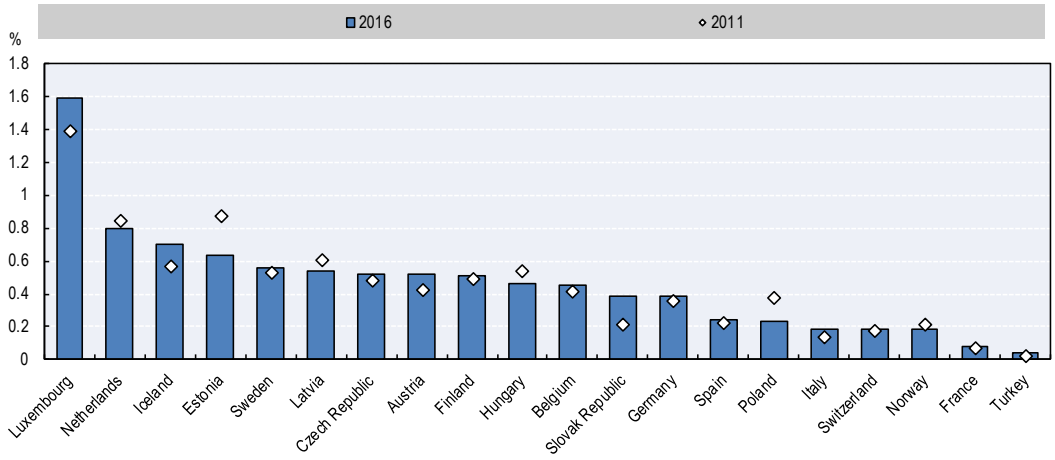
Notes: Graduates at the tertiary level comprise individuals that have obtained a degree at ISCED-11 Levels 5-8. For the Netherlands, data exclude doctoral graduates. For Japan, data are not available because ICTs are included in other fields of study.

Source: OECD (2017d), *OECD Science, Technology and Industry Scoreboard 2017: The Digital Transformation*, http://dx.doi.org/10.1787/9789264268821-en.

In addition, the weak supply of data specialists may contribute to holding back the diffusion of BDA and firms' potential for DDI. Firms with more intensive use of data specialist skills are both more likely to innovate and to have faster productivity growth (OECD, 2015a). Despite the low uptake of BDA in Sweden, the share of data specialists employed in the economy is comparatively high, indicating respective demand (Figure 3.22).

Figure 3.22. **Employment of data specialists**

Percentage of total employment



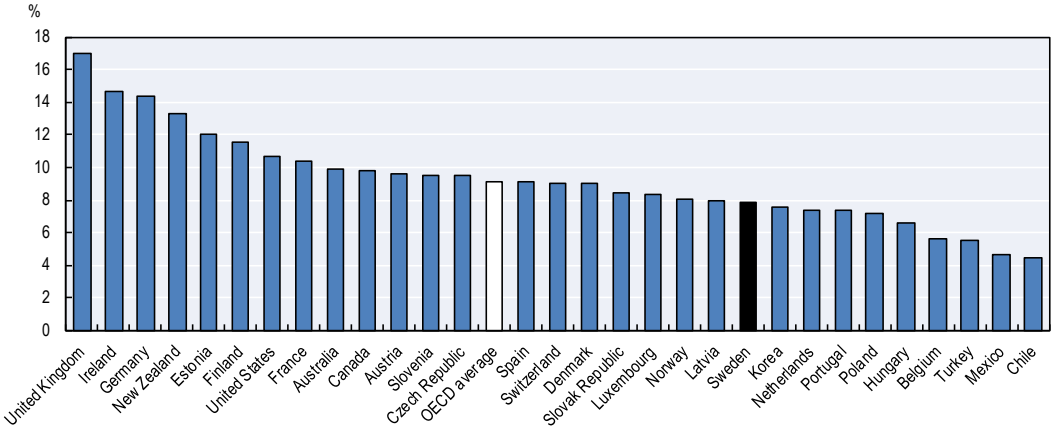
Notes: Data specialists are defined by ISCO-08 codes 212 "Mathematicians, actuaries and statisticians" and 252 "Database and network professionals". Countries for which detailed data are unreliable or not available are not included. For Luxembourg data are for 2015 instead of 2011. For France and Turkey data are for 2014 instead of 2011. For the Netherlands data are for 2013 instead of 2011. For Germany data are for 2012 instead of 2011.

Source: EU Labour Force Survey, November 2017, http://ec.europa.eu/eurostat/web/lfs/data/database.

In view of Sweden's need to boost BDA and of strong demand for data specialists, the current supply of related skills, as measured by the share of tertiary graduates in ICT and data specialist-related studies, is markedly low (Figure 3.23).

Figure 3.23. **Tertiary graduates in ICT and data specialist studies, 2015**

Percentage of all tertiary graduates



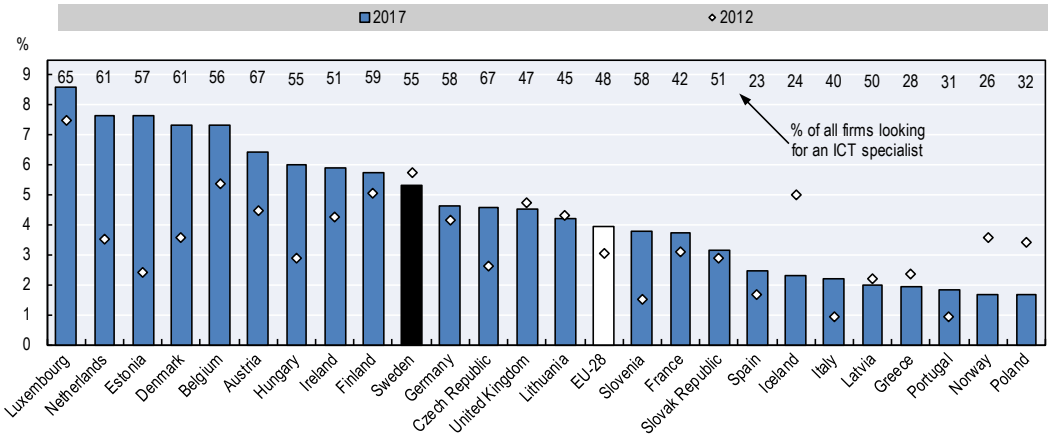
Notes: The fields of studies in this graph include ICTs, natural sciences, mathematics, and statistics. No/insufficient data is available for Greece, Iceland, Israel, Italy and Japan.

Source: Based on OECD (2017a), *Education at a Glance 2017: OECD Indicators*, http://dx.doi.org/10.1787/eag-2017-en.

High demand for both ICT and data specialists and the low supply of related skills documented above also resonates with an above average share of enterprises reporting hard-to-fill vacancies for ICT specialists, an important share of which are data specialists (Figure 3.24).

Figure 3.24. **Firms reporting hard-to-fill vacancies for ICT specialists**

Percentage of all firms



Note: ICT = information and communication technology.

Source: OECD (2017c), *OECD Digital Economy Outlook 2017*, http://dx.doi.org/10.1787/9789264276284-en.

Policies need to strengthen the diffusion of big data analysis and boost skills supply for data-driven innovation

Improving the business environment and targeting measures to strengthen diffusion

A general condition for the diffusion of digital tools among firms is a favourable business environment. The extent to which a business environment is conducive to diffusion of digital tools is affected by policy and structural factors such as product market regulations, employment protection legislation, insolvency regimes and risk capital markets (OECD, forthcoming b). Of particular importance are policies that foster competitive pressures, business dynamism (i.e. rate of churn), resource reallocation, as well as experimentation, notably facilitated by regimes that allow successful firms to scale up and grow while letting less successful ones scale down or exit (Andrews and Criscuolo, 2013).

More specifically, targeted policy measures should be considered to boost technology diffusion, such as is the case in over two-thirds of OECD countries (OECD, 2017c). The overarching goal for such policies in Sweden is provided in the Digital Strategy, which stipulates to "make Sweden the best country in the world in using the possibilities of digitization" (Government Offices of Sweden, 2017b). In addition, the Smart Industry Strategy aims to: i) help firms take advantage of digitisation regardless of the industry, firm size or geographic location; and ii) stimulate the development, deployment and use of digital technology that has high potential to drive industrial transformation. The first objective of the Smart Industry Strategy is being implemented primarily via the "extended digitisation lift" programme (Box 3.2) (Ministry for Enterprise and Innovation, 2016).

The second objective of the Smart Industry Strategy – to stimulate the development, deployment and use of digital technology that has high potential to drive industrial transformation – is being implemented through a range of "digitalisation pilots" that foster collaboration between industry and research (see Chapter 5).

On DDI, the Digital Strategy also highlights the need for building DDI capacity in Sweden, and specifically calls for:

- opening access to research data in open and reusable formats, e.g. from biobank collections, including to contribute to solutions regarding major public health issues
- using real-time data for management, product improvements, risk and vulnerability analysis, and decision support, e.g. for crisis management or transport systems
- improving collaboration between public actors, small and large companies, research institutes and academia with the aim to transform research into practical applications.

DDI is also covered by Vinnova's mandate to promote advanced digital developments in Swedish industry. In its current mission, Vinnova supports a range of data-driven projects with Swedish firms of different sizes in selected industries including trade, construction and transport. Focus areas of these projects include BDA, machine learning, artificial intelligence, augmented reality and encryption, among others. The current round of projects will be supported until the end of 2018 with a public budget of EUR 10 million and up to 50% private co-financing (Vinnova, 2016).

Box 3.3. **The Digilyft programme**

The Digilyft programme is implemented by Sweden's Agency for Economic and Regional Growth with the objective to promote the use of digital tools among SMEs, with a focus on manufacturing and related services.

The programme creates awareness among SMEs about the benefits of using digital tools, notably by organising workshops, including in collaboration with trade unions and business associations. Digilyft furthermore offers targeted coaching and training for firms, for example on digital marketing, including through online learning modules. The Agency for Economic and Regional Growth also provides vouchers to firms proposing a project that makes innovative and strategic use of digital technology. Such a voucher can subsidise up to 50% of the total project value within a limit of EUR 25 000. Firms can spend these funds on either information technology (IT)-related equipment or services.

Return on experience has shown that the firms applying for vouchers are from a large variety of sectors, including areas that are traditionally not prone to using digital technology. Two recurrent themes that firms put forward on their voucher applications are the need to address digital security and privacy issues. On privacy, in particular small firms are searching for support in the implementation of the European Union's General Data Protection Regulation. On security, most firms are lacking a general understanding of how to address digital security from an economic perspective.

Source: Information provided to the OECD during the fact-finding mission in 2017 by the Agency for Economic and Regional Growth.

Increasing ICT skills training to foster diffusion and effective use of digital technologies

Skills are a key asset for diffusion and effective use of digital technologies. A fundamental condition to empower individuals for the digital workplace are sound foundational skills – literacy, numeracy and problem solving; these skills not only enable learning in fast-changing digital environments, but are also the basis for acquiring generic and more advanced ICT skills (OECD, 2016c). As discussed above, reading skills and problem solving in technology-rich environments are widely used in Sweden, while weaknesses remain in writing and in numeracy skills. These weaknesses need to be addressed to fully empower people both for life and for work in the digital era.

An additional condition for diffusion and effective use of digital tools are ICT skills. While the use of ICT skills at work in Sweden is above the OECD average, Sweden still lags behind most of its comparable countries. Recent OECD analysis finds that the uptake of tools such as CRM or cloud computing is significantly related to an increase in workers' ICT skills. The biggest effects on technology diffusion are found to result from the training of low-skilled workers (OECD, forthcoming b). For example, an increase by one standard deviation in the share of low-skilled workers (with low training) that receive training is associated with a 3 percentage points increase in the share of firms adopting CRM or cloud computing systems in knowledge-intensive industries relative to other industries; this compares to only 1.7 percentage points higher adoption from the same increase in training for highly skilled workers (Figure 3.25).

Figure 3.25. **Complementarity between training and technology adoption**

Differential association of training provided to high- and low-skilled workers with the percentage of firms adopting customer relationship management and cloud computing systems

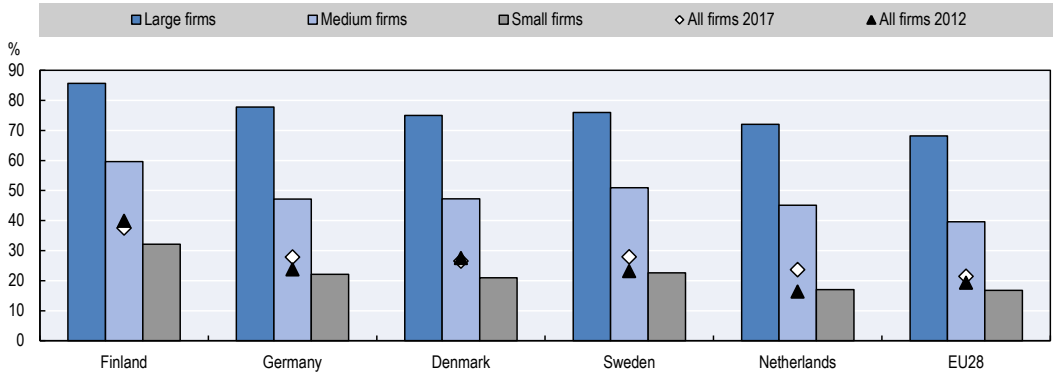
Notes: This figure shows the *ceteris paribus* impact of an increase of a one standard deviation (11% for low-skilled workers, 13% for high-skilled ones) of the percentage of high-/low-skilled workers having participated in formal training on the percentage of firms adopting customer relationship management/cloud computing technologies between industries with a high or low knowledge intensity.

Source: based on OECD (forthcoming b), "Going digital: What determines technology diffusion among firms?".

While the need for training is strategically recognised in Sweden, the share of firms providing training to their workers in Sweden is still lower than in comparable countries. The Digital Strategy and the Smart Industry Strategy both highlight the importance of training and lifelong learning for workers and call for the responsibility of both private and public actors, pointing notably to: i) universities' task to meet digital skill needs of students in view of a changing world of work; ii) better usage of digital education tools in continuous professional training; and iii) employers' responsibility (Government Offices of Sweden, 2017b; Ministry for Enterprise and Innovation, 2016). Figure 3.26 shows that the proportion of Swedish firms providing ICT skills training to their workers is lower than in Finland, Germany and Denmark. In particular, SMEs are lagging behind and may need more support.

Figure 3.26. **Firms providing training to their personnel to develop ICT skills, 2017**

Percentage of non-financial firms



Source: Eurostat (2018a), *ICT Usage in Enterprises*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

Recent proposals by the government for new policy measures to improve lifelong learning, to be implemented over the course of 2018, include (Government Offices of Sweden, 2017c; 2017f):

- **Vocational training**. Through the knowledge lift the government plans the creation of more than 90 000 additional permanent places in regional vocational education programmes, high schools, colleges and universities. Total government spending for the knowledge lift is expected to sum up to over EUR 1.2 billion by 2021. Additional investments include EUR 120 million in 2018 to finance 7 750 education enrolments, 1 000 of which are in regional vocational training programmes; EUR 32 million to strengthen the quality and the range of available vocational training programmes; EUR 23 million annually from 2022 onwards to extend vocational training programmes that enable students to continue higher education after upper secondary school.
- **Local centres for lifelong learning**. The government plans to spend EUR 5 million in 2018 and thereafter EUR 7 million annually in the form of a state contribution to municipalities to support the development of local learning centres. These centres should be accessible to students and teachers from different levels of education, including adult education and university, and function as an open learning environment, i.e. a physical site for students to meet and receive study support, including for distance learning.

Many of the policies implemented in other OECD countries to boost diffusion and effective use of digital technologies are focused on awareness raising, skills and training, for example Portugal's "INCoDe.2030", which provides a comprehensive approach to digital literacy and competences, training and employability (Box 3.4).

Other examples include Australia providing "digital business kits" with case studies and tailored advice for digital business management; Switzerland providing information and advice via online portals on themes such as skills (e.g. digital.swiss); and Germany's "Trusted Cloud" training programme that targets SMEs to help firms better understand possible applications of cloud computing (OECD, 2017c).

Box 3.4. **Portugal's National Initiative on Digital Competences 2030**

Portugal's National Initiative on Digital Competences 2030 (INCoDe.2030) aims to broaden digital literacy, promote employability and professional training in digital technologies, and to raise the national participation in the international R&D network, namely in the production of knowledge in all the areas associated with digital transformation.

INCoDe.2030 aims to make use of existing training infrastructure to improve overall levels of ICT competences. The programme takes a broad view of competences, including digital literacy, information processing, as well as communication and digital content production skills. It also fosters the use of digital technologies and the ability to handle and manipulate data, and considers the need to increase the understanding of advanced communication networks and mobile systems, network hardware and software, and cyber-physical systems like robotics.

INCoDe.2030 includes a range of interventions alongside the promotion of digital competences. It enables citizens to benchmark their level of digital competences and identify knowledge gaps based on the European initiative DigComp2.0. Specific programmes target disenfranchised groups, which get access to free online training. Further elements of the programme include lifelong learning and active labour market programmes for disenfranchised workers to help workers adapt to a dynamic labour market.

Source: Based on OECD (2018b), "Going digital in a multilateral world", www.oecd.org/mcm/documents/C-MIN-2018-6-EN.pdf.

Boosting short- and long-term supply of ICT and data specialists

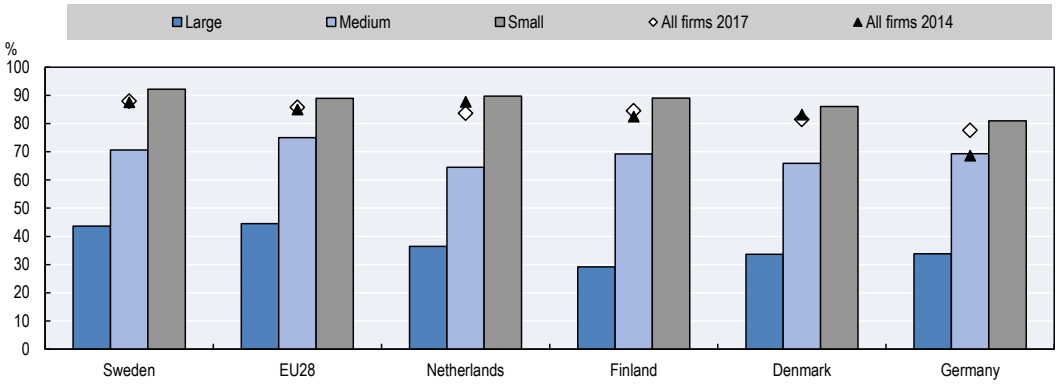
As discussed above, much potential remains to increase the supply of ICT and data specialists to close the current gap with high demand. This finding is supported by the assumption made in the Smart Industry Strategy that a shortage of workers with appropriate skills is one of the biggest obstacles to the growth of Swedish industry today. ICT specialist skills are also a strategic focus of the Digital Strategy,[3] which points in particular to the importance of technical skills for using and developing digital tools and services. Both strategies call for a closer matching of the education system with employers' digital skill needs by improving and complementing existing collaboration between upper secondary schools, higher education, research and industry (Government Offices of Sweden, 2017b; Ministry for Enterprise and Innovation, 2016), such as practiced in training provided by the Agency for Higher Vocational Education (DK, 2015a).

In addition to offers in public education and training institutions, an effective way of upskilling, notably in the shorter term, is training provided by firms to their employees. With regards to firm-provided ICT specialist training, Sweden has much room to improve, currently ranking above the EU28 average for the share of firms that do not provide any training to develop the ICT specialist skills of their employees (Figure 3.27).

Increasing the supply of ICT and data specialists over the longer term should also be a priority and will require making relevant subjects more attractive to students pursuing a tertiary education. The Smart Industry Strategy draws attention to the need to increase in particular the attractiveness of science and technology studies, pointing to the greater interest of many Swedish students for social issues rather than for mathematics and technology, as well as to the fact that the latter are unpopular also for teacher careers (Ministry for Enterprise and Innovation, 2016). This resonates with the findings from PISA 2015 that among 15-year-old students in Sweden, only 20% expect to be in a science-related career at the age of 30, compared to an OECD average of 25%. Among those Swedish students who expect to pursue a science-related career, only 3% expect it to be in ICTs.

Figure 3.27. **Firms that do not provide any training to develop ICT specialist skills, 2017**

Percentage of non-financial firms



Source: Eurostat (2018a), *ICT Usage in Enterprises*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

However, signs for a change in attitude exist, and the government has started to take action. PISA 2015 found that 74% of Swedish students agreed that making an effort in science classes in school will help them in their professional life, which is 12 percentage points more than in 2006 (OECD, 2015b). The government has recently proposed several measures to be implemented over the course of 2018 to foster interest among students with upper secondary education from engineering or natural sciences programmes to participate in engineering studies at university as well as to facilitate the integration of immigrants with an engineering or science background into the Swedish labour market. These measures are planned to be supported with EUR 1.1 million annually in 2018 and 2019, which includes funding of internship opportunities for immigrant engineers (Government Offices of Sweden, 2017g).

Finally, complementary skills are expected to increase in importance with the ongoing digital transformation of organisational forms and business models. Several reports by the Digitalisation Commission have highlighted the importance of complementary skills, such as communication, influencing, leadership and collaboration skills (DK, 2015b; 2016). While neither the Digital Strategy nor the Smart Industry Strategy highlight the importance of such skills, Sweden's good ranking on the High-performance Work Practices Index (discussed earlier) should encourage continued efforts to strengthen school and university graduates' complementary skills relevant for new forms of management and work organisation.

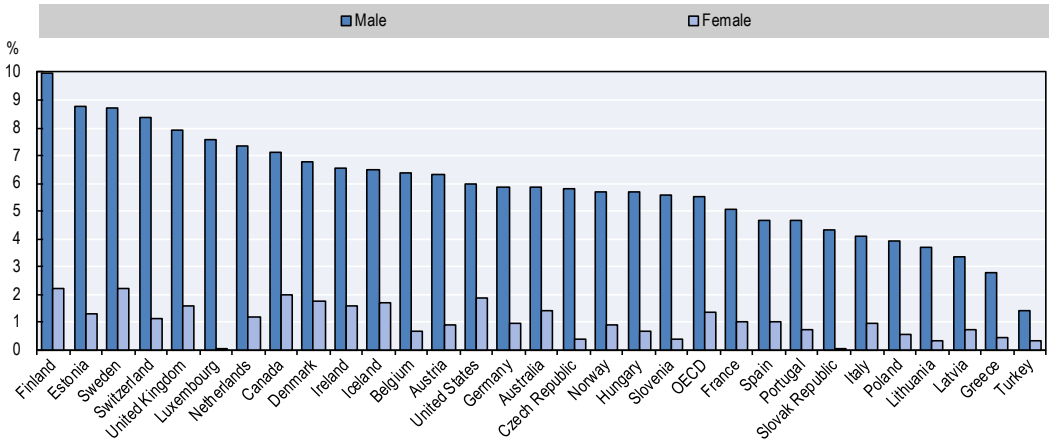
Enhancing women's participation in digitally intensive occupations

Another way to boost the supply of ICT and data specialists would be to increase the share of women in related occupations (DK, 2015b). The overarching goal on gender equality stated by the Digital Strategy is that "women and men should have the same power to shape society and their own lives"; and, more specifically, "women and men, girls and boys, regardless of social background, functional capacity and age, shall be offered the opportunity to access digital information and services from the public and participate in an equal manner in society" (Government Offices of Sweden, 2017b). Already the 2011 IT for Everyone, a digital agenda for Sweden, had the aim to substantially increase the proportion of women in IT-related occupations and women studying in courses with IT specialisations by 2020.

Despite some improvements on gender equality noted in a 2016 evaluation of the Digitalisation Commission, much remains to be done (DK, 2016). Indeed, notwithstanding the long-standing ambitions and efforts of the government, the gender divide remains substantial. While compared to other countries Sweden has a relatively high share of female ICT specialists (2%) as a share of all workers, it is also among the countries with the largest gender difference, with almost 7 percentage points more male than female ICT specialists (Figure 3.28).

Figure 3.28. **ICT specialists by gender, 2016**

Percentage of all male and female workers

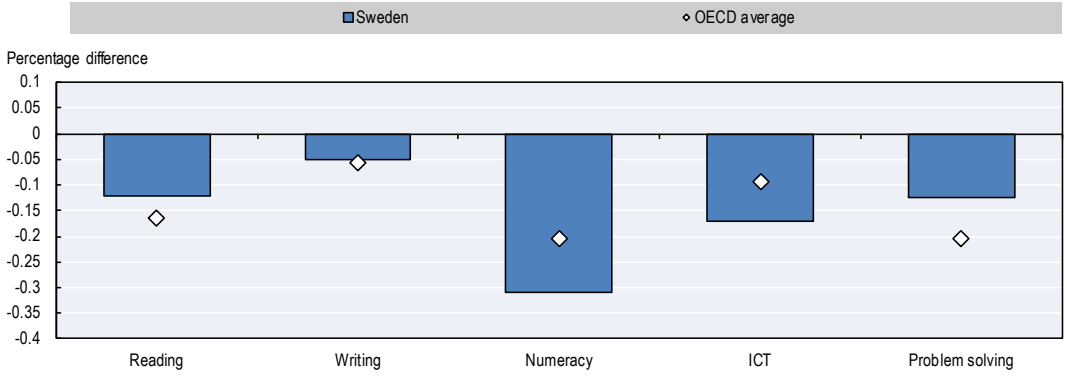


Notes: ICT specialists are defined as those individuals employed in "tasks related to developing, maintaining and operating ICT systems and where ICTs are the main part of their job". The OECD operational definition is based on ISCO-08 and includes groups 133, 215, 25, 35 and 742 (for further details see OECD [2004; 2013]). OECD aggregate is a weighted average for all countries for which data are available. Data for Canada and the United States refer to 2015.

Source: OECD (2017c), *OECD Digital Economy Outlook 2017*, http://dx.doi.org/10.1787/9789264276284-en.

Figure 3.29. **Gender differences in the use of information-processing skills at work, 2015**

Difference between men and women (adjusted)



Notes: ICT= information and communication technology. Adjusted estimates are based on OLS regressions including controls for literacy and numeracy proficiency scores, hours worked, and occupation dummies (ISCO 1-digit).

Source: OECD (2017e), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis/#d.en.408927.

The gender divide in ICT specialist occupations resonates with a gender imbalance in information-processing skills used at work (Figure 3.29). Compared to the OECD average, this imbalance is characterised by a pronounced difference between men and women in numeracy and ICT skills used at work, both of which are crucial for acquiring advanced ICT and data specialist skills, and more generally to succeed in digitally intensive occupations.

Both numeracy and ICT skills are acquired to an important extent in education in science, technology, engineering, and mathematics (STEM). Reducing the current gender divide would thus benefit from a focus on STEM education, as can be found in many countries across the OECD (Box 3.5).

Box 3.5. **Examples of countries' efforts to reduce the digital gender divide**

A number of countries have measures to engage women and girls in STEM across education systems, for example:

- The Australian government is investing AUD 13 million over five years from 2016/17 into initiatives focused on women's participation in STEM. The National Innovation and Science Agenda is contributing to ongoing efforts across the Australian government to encourage more girls and women to study STEM and pursue STEM-based and entrepreneurial careers.
- The Japanese government is carrying out the Riko Challenge to inspire women to choose careers in STEM and increase the number of female science and engineering professionals.
- The OECD Mexico initiative, NiñaSTEM PUEDEN, launched in early 2017, invites Mexican women who have prominent careers in science and mathematics to act as mentors to encourage girls to choose STEM subjects. Codigo X in Mexico is a programme to orientate women to disciplines related to STEM and to promote the inclusion of girls and women in ICT sectors.
- Germany launched in 2008 the National Pact for Women in MINT (STEM) Careers to increase women's interest in scientific and technical studies. The initiative brings together politics, business, science and the media to improve the image of STEM-related professions in society.
- In the United States, the Department of Education's programme, Race to the Top, launched in 2009, prioritises improving STEM in the grants it awards to states. The Investing in Innovation programme seeks to increase the number of STEM teachers from groups traditionally under-represented in STEM; and the National Science Foundation awards grants to support the ADVANCE programme, which aims at increasing the participation and advancement of women in academic science and engineering careers.

Source: based on OECD (2018a), "Empowering women in the digital age: Where do we stand?", www.oecd.org/social/empowering-women-in-the-digital-age-brochure.pdf.

Recommendations

This section shows that the diffusion of many digital technologies among Swedish firms is widespread, in particular of basic digital tools, and tools for digital market integration and digital firm organisation. Furthermore, many of the skills needed to make effective use of these tools are widely used.

However, several points merit attention for policy action, in particular: lagging adoption of the most advanced digital tools by SMEs; weak diffusion of BDA among all firms; low supply of ICT and data specialists; and the gender divide among digitally intensive occupations and skills. The government may therefore consider:

1. **Promoting widespread diffusion of advanced digital technologies, in particular among SMEs, with a focus on the diffusion of BDA**, possibly through a national big data strategy. In addition to the existing measures supporting data analytics in selected flagship projects, a wider approach is needed that incentivises firms to use BDA and fosters complementary investment by firms in different sectors and firms of different sizes, and in particular SMEs.
2. **Review training and education policies to boost the supply of ICT and data specialist skills, reduce the gender divide, and anticipate the growing need for complementary skills**. In the short term, incentives for individuals and workplaces should ensure swift training for re- and/or upskilling to boost workers' ICT and data specialist skills, the supply of which should be also enhanced over the longer term though educational institutions. All measures for reskilling and skills supply should be co-ordinated with social partners and industry and contribute to closing the digital gender divide. The need for complementary skills should be considered jointly with other skill needs, possibly in a comprehensive digital skills strategy.

Progress towards digital government in Sweden

The uptake of digital public services is unequally distributed

A key objective of the government's and the public sector's use of digital technologies is to improve public service delivery to citizens and businesses. The Swedish digital government ambitions are high, stating that "state authorities, municipalities and regions should be the best in the world to use digitalisation's opportunities to create a simpler everyday life for individuals and businesses, an efficient public sector with high-quality services, as well as more jobs and increased growth" (Government Offices of Sweden, 2017b).

The government's efforts to implement and improve digital public services over recent years are bearing fruit, as shown in the European Union's 2017 e-government benchmark report, which documents progress in Sweden across almost all of its indicators (European Commission, 2017). Sweden is currently working with the OECD on implementing the OECD's more comprehensive approach to digital government, as outlined in the *OECD Recommendation on Digital Government Strategies* (OECD, 2014; forthcoming a).

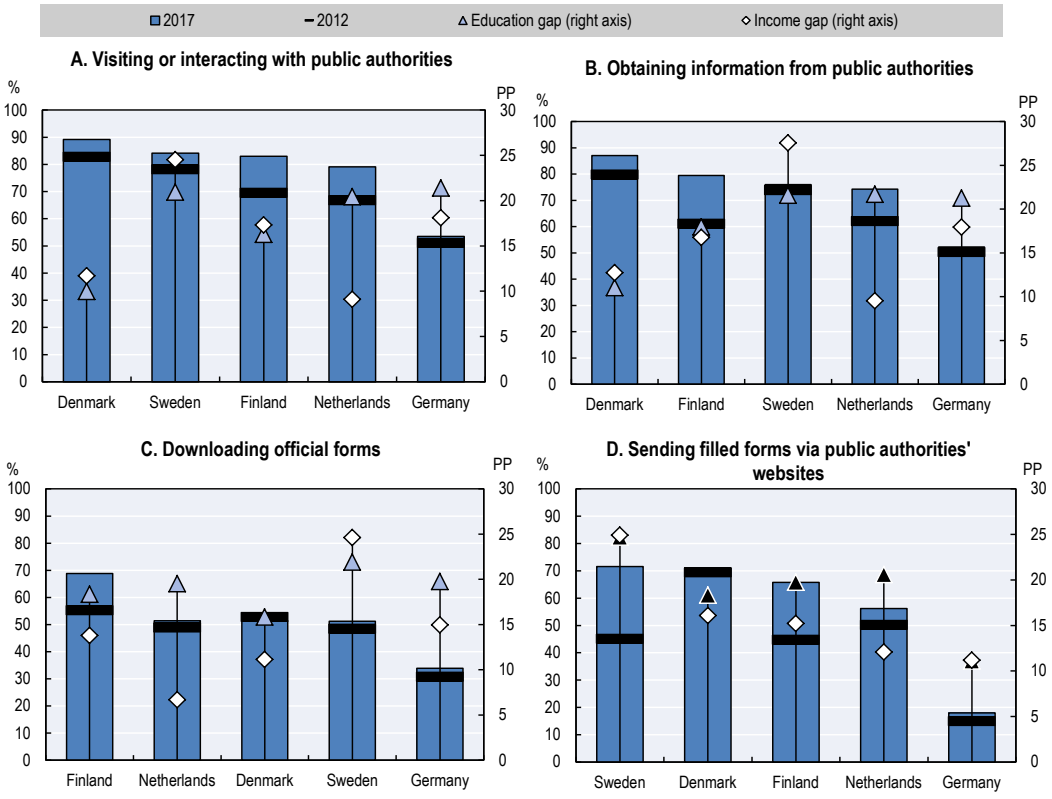
However, some basic indicators, such as on the uptake of digital public services by individuals, still show much room for improvement. While overall uptake of different online interactions with public authorities is progressing, among comparable countries, uptake in Sweden is the most unequal, with over a 20 percentage point difference between individuals with high versus those with a low education (education gap) as well as between individuals with a high versus those with a low income (income gap) in all four indicators presented in Figure 3.30 (Panels A-C).

There is also a growing divide in the use of digital public services across areas of different population density. The gap between individuals interacting on line with public authorities in low population density areas versus those in high population density areas has widened significantly over recent years: from just over 2% in Sweden in 2012 to 14% in 2017, that is to the level of the EU28 average gap in 2017 (Figure 3.31). This occurs despite a slight decrease in the difference between urban versus rural areas in general

Internet usage, from 6 percentage points in 2010 to 5 percentage points in 2016. It also occurs despite higher annual average growth in online interactions with public authorities among 55-74 year-olds as compared to 25-54 year-olds, the former of which are more likely to live in sparsely populated areas.

Figure 3.30. **Individuals using the Internet for digital government services**

Percentage of individuals and percentage points

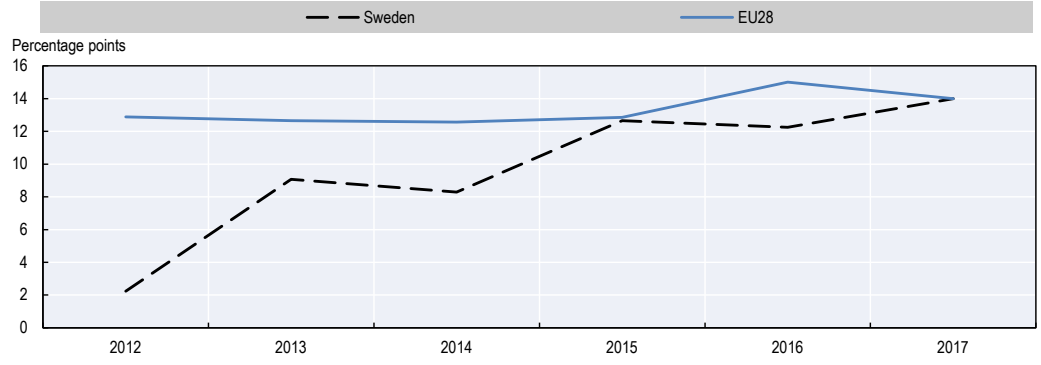


Notes: PP = percentage point. For details see Endnote 4.

Source: OECD (2018c), *ICT Access and Usage by Households and Individuals* (database), http://oe.cd/hhind.

Figure 3.31. **Individuals using the Internet to interact with public authorities by population density**

Percentage point difference between high and low population density areas

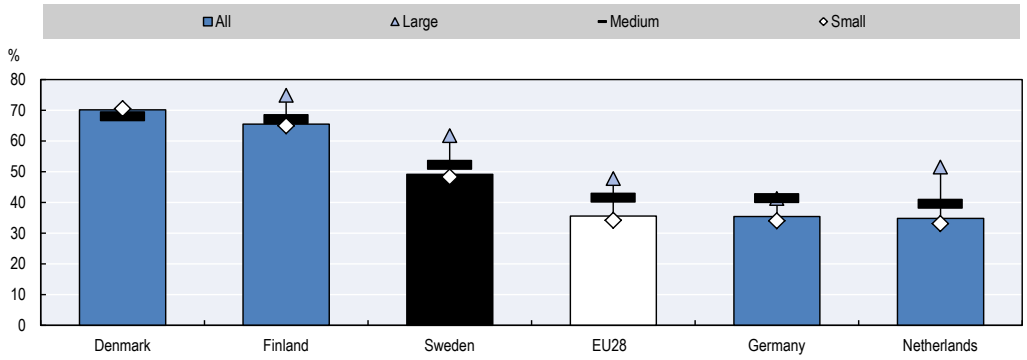


Source: Eurostat (2018b), *ICT Usage in Households and by Individuals*, http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database.

Digital public services can also boost interactions with firms and reduce costs, for example the burden of firms' annual reporting. While recent comparable data on firms' use of public services is limited, data on firms using the Internet to issue/send invoices to public authorities shows good progress in Sweden compared to the EU28, although not yet at the levels of Finland and Denmark (Figure 3.32).

Figure 3.32. **Firms using the Internet to issue/send invoices to public authorities, 2016**

Percentage of non-financial firms, by firm size



Notes: Includes issuing/sending electronic or paper invoices. All firms = 10 employees and more; large firms = 250 employees and more; medium firms = 50-249 employees; small firms = 10-49 employees.

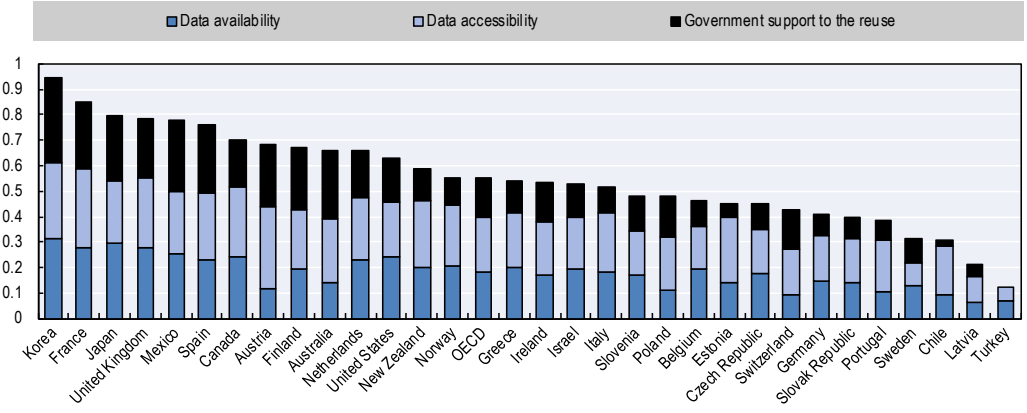
Source: OECD (2018d), *ICT Access and Usage by Businesses* (database), http://oe.cd/bus.

Much potential remains to improve open government data

Digital technologies enable governments to create new value by opening up government data. While some of this data can be useful within the public sector itself, opening it up to the public promotes innovation among individuals and businesses (DK, 2016). While Sweden has a national open data portal (www.öppnadata.se), operated by the National Archives of Sweden, in comparison to other OECD countries, current efforts on open government data do not seem enough. In 2017, the value of the OECD OURdata (open, useful, reusable government data) Index for Sweden was among the lowest in the OECD (Figure 3.33).

Figure 3.33. **Open, useful, reusable government data, 2017**

OECD OURdata Index



Notes: Data for Hungary, Iceland and Luxembourg are not available. Denmark does not have a central/federal data portal and therefore is not displayed in the index.

Source: OECD (2017b), *Government at a Glance 2017*, http://dx.doi.org/10.1787/gov_glance-2017-en.

Policies need to bolster equal access to digital public services and promote open government data

Making digital public services equally accessible across the country

Sweden's current "Digital First" policy for the digitalisation of the public sector was initiated in 2015 and will run until 2018. The policy aims to strengthen governance and co-ordination and promotes simple transparent, and efficient public management. Its primary goal is to make digital services the main means for the public sector to interact with individuals and companies (Box 3.6). Following the direction of the 2012 national strategy "Bringing the Citizen to the Heart of Government", Digital First is further pursuing the core principle of putting the individual user at the centre of all public services design (Government Offices of Sweden, 2012).

Box 3.6. **Digital First**

Digital First has two main pillars: core actions to speed up the digitalisation of the public sector and targeted initiatives in selected areas.

The core actions of Digital First are:

- improvements of national digital infrastructure, including for municipalities and county councils
- increasing digital maturity in all levels in the public sector
- capacity building for digital innovation, with a focus on open data
- reviews of laws and regulation
- the creation of a new digital government agency.

The new Agency for Digital Government will be operational from 1 September 2018, and will be tasked with co-ordinating and supporting the digitalisation of the public sector, promoting user-driven design, including among municipalities. It will focus, among other things, on developing and managing a national digital infrastructure and will take over several responsibilities that are currently spread across different authorities, such as for open data and e-IDs.

The targeted initiatives implemented under Digital First focused on: i) smart community building processes (housing construction); ii) smarter food chains; iii) smart environmental information; iv) digital enterprise services for restaurants. On the latter, for example, the government is simplifying administrative procedures necessary to start and run a restaurant and plans to extend this initiative to the accommodation sector thereafter – in a joint effort with the SKL.

Source: Government Offices of Sweden (2017a), "Digitalisering av offentlig sektor" (in Swedish), www.regeringen.se/regeringens-politik/digitaliseringspolitik/digital-forvaltning.

Another goal of the Digital First policy is to reduce differences in the availability and quality of digital services across municipalities and regions (Government Offices of Sweden, 2017a). The efforts to reach this goal are undertaken jointly by all levels of government, as stated in a 2015 letter of intent between the central government and the SKL (Government Offices of Sweden, 2015a). Also in 2015, a Council for the Digitization of Public Sweden, with representatives from 11 authorities, municipalities and county councils and a representative

of the SKL, was set up to identify strategic issues and challenges to be addressed to increase territorial equality. The council's mandate ends by the end of 2018 (Government Offices of Sweden, 2015b). A key challenge to is to bridge currently often isolated digital systems in different parts of the government and across different levels of government, which requires improving interoperability and adopting common standards, e.g. for e-health services.

An important condition for fostering the use of advanced online activities, including interactions with public authorities, is a simple and secure digital identity (e-ID) (Government Offices of Sweden, 2017b). e-IDs are widely used in Sweden, but the current system faces challenges. In the early 2000s, Sweden opted for a market-based approach to offering e-ID solutions, which led to a scattered ecosystem in which several e-ID issuers are active today and bank-provided e-IDs are the most trusted and used solutions. Steps to improve the current system, including security requirements for e-IDs, are expected to be initiated by the e-ID board (Government Offices of Sweden, 2017d).

Several additional initiatives, budgeted for 2018, aim at advancing the digitalisation of public administrations and improving public services. The 2018 Budget Bill notably includes funds to support open data initiatives over a three-year period and measures to standardise and improve information exchange between public authorities. These measures support the implementation of the "once only" principle, that is to say that data from individuals or businesses will need to be collected once only to be accessible for all relevant agencies and authorities across the public sector (Government Offices of Sweden, 2017h).

Stepping up efforts to use and open up government data

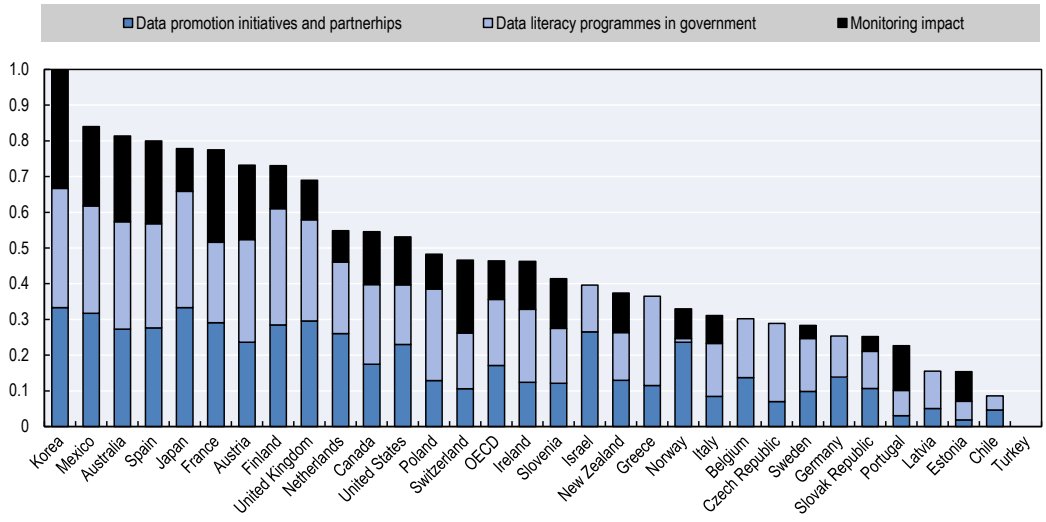
Sweden has worked towards opening up government data for many years, but overall results are still limited. Transposing the European Union's 2003 Directive on the reuse of public sector information (PSI Directive) into domestic legislation, in 2010, Sweden adopted the Reuse of Documents from Public Administration Act (DK, 2016). While this created pressure on authorities to publicise data, a 2015 evaluation of the act's implementation by the State Treasury concluded that much work remains to be done (DK, 2016). Overall results of Sweden's efforts on open government data indeed still have room to be improved, as indicated by Sweden's ranking in the 2017 OECD OURdata Index (Figure 3.34).

Barriers to improving open government data, identified by the OECD (forthcoming a), include the verticality of Sweden's public sector model, characterised by relatively small ministries and strong and independent public agencies; a focus on citizens' right to request public sector information, but not on the proactive role of government agencies to open up government data; fee-based financing models of some agencies selling data; and changing governance and leadership for open data since 2011 (OECD, forthcoming a).

The need for action has been noted by the Digital Strategy, which calls to improve access to and facilitate the reuse of public sector information and government data. The strategy points out in particular the objectives to improve the public sector's capacity to better reuse its own data, within and between authorities; to use public procurement to promote the development, use and implementation of digitally driven innovations; and to use open source solutions, standards and testbeds.

Figure 3.34. **Government support to the reuse of data, 2017**

OURdata Index



Note: Data for Hungary, Iceland and Luxembourg are not available. Denmark does not have a central/federal data portal and therefore is not displayed in the index.

Source: OECD (2017b), *Government at a Glance 2017*, http://dx.doi.org/10.1787/gov_glance-2017-en.

Important initiatives to step up the government's efforts to implement some of the above-mentioned objectives of the Digital Strategy include (Government Offices of Sweden, 2017e):

- **Open data availability**. The Swedish Agency for Public Management (Statskontoret) has been tasked with mapping barriers to the reuse of open data. This mission complements the National Archives of Sweden's mission to promote government agencies' efforts to make data available for reuse.
- **Reuse of open data**. The Swedish Growth Agency has been tasked with promoting open and DDI, which is expected to increase the reuse of open data. This mission includes the development of a platform that public actors can use to crowdsource solutions to challenging problems, including from academia and businesses.
- **Data-driven management and innovation**. The central government allocated funding to develop national digital services and to enable free sharing of basic data such as census data, between government agencies with the aim to reduce the cost of billing and redundant storage, as well as better use of data to foster innovation in the public sector.

Recommendations

This section showed that despite progress towards digital government, much remains to be done, in particular with regards to divides between different users of digital public services and to opening up and better using government data. The OECD *Digital Government Review of Sweden: Fostering a Data-Driven Public Sector for Public Value Co-Creation* (OECD, forthcoming a) provides a comprehensive set of recommendations. As part of these recommendations, the government may consider, in particular:

1. **Promoting equal access to digital public services by facilitating usage among lagging groups and territories**. Improving ease of use through user-driven design of services; fully implementing the once only principle; and enhancing interoperability among systems at national, regional and municipal levels, including through a national digital infrastructure and the implementation of common standards.
2. **Continuing to step up efforts to make open government data available and accessible for public reuse and innovation** and for better internal use, including through a national digital infrastructure that supports linked data, harmonised data formats, and better horizontal and vertical integration of data within and outside of the public sector, such as through data partnerships with private actors.

Notes

1. Broadband includes both fixed and mobile connections with an advertised download rate of at least 256 kilobits per second.

   E-purchases and e-sales refer to the purchase and sales of goods or services conducted over computer networks by methods specifically designed for the purpose of receiving or placing orders (i.e. webpages, extranet or electronic data interchange [EDI], but not orders by telephone, fax or manually typed e-mails). Payment and delivery methods are not considered.

   Enterprise resource planning (ERP) systems are software-based tools that can integrate the management of internal and external information flows, from material and human resources to finance, accounting and customer relations. Here, only sharing of information within the firm is considered. Data for ERP relate to the year 2015.

   Cloud computing refers to ICT services used over the Internet as a set of computing resources to access software, computing power, storage capacity and so on.

   Supply-chain management (SCM) refers to the use of automated data exchange (ADE) applications. Data for SCM relate to the year 2015.

   Customer relationship management (CRM) software is a software package used for managing a company's interactions with customers, clients, sales prospects, partners, employees and suppliers. Data for CRM relate to the year 2015.

   Social media refers to applications based on Internet technology or communication platforms for connecting, creating and exchanging content on line with customers, suppliers or partners, or within the enterprise. Social media might include social networks (other than paid adverts), blogs, file-sharing and wiki-type knowledge-sharing tools.

   Radio frequency identification (RFID) is a technology that enables contactless transmission of information via radio waves. RFID can be used for a wide range of purposes, including personal identification or access control, logistics, retail trade and process monitoring in manufacturing. Data for RFID relate to the year 2014.

   Unless otherwise stated, only enterprises with ten or more employees are considered.

Broadband: for Australia, includes "DSL", "fibre to the premises", "cable", "fixed wireless", "mobile wireless", "satellite" and "other". For Canada, it includes all connection groups except dial-up connection.

E-purchases: for Australia, data refer to the proportion of businesses placing/receiving orders over computer networks by methods specifically designed for the purpose (includes webpages, extranet or EDI). It includes any transaction where the commitment to purchase was made via the Internet, including via e-mail. For New Zealand, data exclude orders initiated via EDI-type messages. For Switzerland, data refer to the share of enterprises buying or selling and no recall period mentioned in the question.

E-sales: for Australia, data refer to the proportion of businesses placing/receiving orders over computer networks by methods specifically designed for the purpose (includes webpages, extranet or EDI). This includes any transaction where the commitment to purchase was made via the Internet.

ERP: for Canada, data relate to the year 2013, and for Iceland and Sweden to 2014.

Cloud computing: for Canada, data relate to the year 2012, and to enterprises that have made expenditures on "software as a service (e.g. cloud computing)".

SCM: for Turkey, data relate to the year 2012.

Social media: for Australia, data refer to businesses that had a social media presence, and for Canada to enterprises for which Internet websites offer integration with social media (e.g. Facebook, Twitter, Google+).

RFID: for Japan, Korea and Switzerland, data relate to the year 2015; for Canada, data relate to 2013 and for Turkey to 2011.

For countries in the European Statistical System, sector coverage consists of all activities in manufacturing and non-financial market services, and data on e-purchases and e-sales refer to 2015.

For Australia and New Zealand, data refer respectively to the fiscal year 2014/15 and the fiscal year 2015/16, ending 30 June, instead of 2016. For industrial classification, ANZSIC06 division is used instead of ISIC Rev.4 division. For Australia, data include agriculture, forestry and fishing.

For Canada, the North American Industry Classification System (NAICS) is used instead of ISIC Rev.4, and data refer to 2013 except for cloud computing (2012).

For Iceland, data refer to the year 2014. For Japan, Korea and Switzerland, data refer to the year 2015.

For Japan, JSIC Rev.13 division is used instead of ISIC Rev.4 and data include total businesses with 100 or more employees instead of 10 and more.

For Mexico, data refer to the year 2012. For Switzerland, data refer to the year 2015, website data refer to 2011 instead of 2016, and data for 2015 refer to firms with five or more employees.

For Switzerland, data for the year 2015 relate to businesses with five or more employees instead of ten or more.

2. Basic tools include shares of non-financial firms that have a broadband connection and a website, and that use social media. Data on social media use are for 2013 and 2017. Market integration tools include shares of non-financial firms placing

orders (i.e. making purchases) and receiving orders over computer networks. Business process tools include shares of non-financial firms using software for ERP, CRM and supply chain management (SCM).

3. ICT specialist skills are referred to as "enhanced skills" in the Digital Strategy.

4. Individuals using the Internet for digital government services during the last 12 months. "Education gap" refers to the percentage point difference between the usage the rates of individuals with a high level of educational attainment versus individuals with no or a low level of educational attainment. "Income gap" refers to the percentage point difference between the usage the rates of individuals living in a household with income in the first quartile and individuals living in a household with income in the fourth quartile.

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