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This publication is a contribution to the OECD Going Digital project, which aims to provide policy makers with the tools they need to help their economies and societies prosper in an increasingly digital and data-driven world.

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Foreword

Governments and stakeholders must work together to shape a digital future that harnesses the immense opportunities of digital transformation to improve the lives of all people. This requires a balancing act that will not be the same for all countries, as cultural and other factors influence the most suitable policy environment. The Going Digital Integrated Policy Framework (the framework) is designed to help countries strike this balance, make better policies in the digital age and ensure that no one is left behind.

The framework helps governments develop well-suited and digital policies. It ensures a coherent and comprehensive whole-of-government approach to realise the potential of digital transformation and address its challenges. The framework is applicable to both OECD Members and partners, and it underpins the OECD Going Digital Toolkit[1], which provides interactive data visualisations and access to key OECD Going Digital indicators, analysis and policy guidance.

The framework is a key output of the OECD Going Digital project. It structures the synthesis report *Going Digital: Shaping Policies, Improving Lives* (OECD, 2019[1]), which contains more in-depth policy analysis and recommendations, and its companion report *Measuring Digital Transformation – a Roadmap for the Future* (OECD, 2019[2]), with a wide range of indicators and a roadmap for better measuring digital transformation. The framework also serves as a basis for OECD national reviews of digital transformation (OECD, 2018[3]) (OECD, 2019[4]).

The framework was developed in partnership with all Committees, bodies, Secretariat staff and stakeholders involved in the Going Digital project. Specifically, it benefitted from feedback from 14 OECD Committees: the Committee on Digital Economy Policy; Competition Committee; Committee on Consumer Policy; Committee on Fiscal Affairs; Committee on Industry, Innovation and Entrepreneurship; Committee on Financial Markets; Committee on Statistics and Statistics Policy; Committee on Scientific and Technological Policy; Economic Policy Committee; Education Policy Committee; Employment, Labour and Social Affairs Committee; Insurance and Private Pensions Committee; Public Governance Committee and the Trade Committee.

The framework also benefitted from feedback from the Going Digital Steering Group, composed of representatives from the above-mentioned OECD Committees, OECD Member countries, as well as four stakeholder groups: Business at the OECD, the Civil Society Information Society Advisory Council, the Internet Technical Advisory Committee and the Trade Union Advisory Committee. Director Andrew Wyckoff and Deputy Director Dirk Pilat of the OECD Directorate for Science, Technology and Innovation provided overall guidance and direction. Contributions from Anna-Sophie Liebender and Christopher Lomax are also gratefully acknowledged.

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Introduction

Digital technologies and data change how people, firms and governments live, interact and work. As digital technologies evolve, these changes are accelerating rapidly. The complex and interrelated effects of digital transformation across the economy and society make hard borders between policy domains less relevant and trade-offs between public policy objectives more difficult to navigate. As a result, stronger co-ordination and collaboration across policy silos is essential. How can we realise the immense promises of digital transformation for growth and well-being in a fast evolving world?

The Going Digital Integrated Policy Framework (the framework) charts the road ahead by helping governments, people, firms and stakeholders shape policies for an inclusive and prosperous digital future. The framework recognises technologies, data and business models as driving forces underlying digital transformation (OECD, 2019[1]), and builds on the cross-cutting analysis of "vectors"[2] of digital transformation across many different policy domains (OECD, 2019[5]). The framework includes seven interrelated policy dimensions: 1) access; 2) use; 3) innovation; 4) jobs; 5) social prosperity; 6) trust; and 7) market openness (Figure 1).

Figure 1. Going Digital Integrated Policy Framework



The framework highlights that all policy dimensions are needed to make digital transformation work for growth and well-being. Each policy dimension brings together multiple policy domains that need to be considered jointly, rather than as separate policy silos, and facilitates co-ordination, while allowing flexibility for policies and/or regulations to evolve.

Leveraging the benefits and addressing the challenges of digital transformation requires co-ordination across all policy domains identified in the framework. It also requires the consideration of transversal policy issues (e.g. skills and digital government) that cut across several of the framework's policy dimensions (OECD, 2019[1]). Another important transversal issue involves data and data governance, but data policies are only emerging and do not currently constitute a separate policy domain.

This report outlines the framework's seven policy dimensions and the policy domains contained therein. It also provides guidance on putting the framework into practice. In particular, it suggests key steps for developing a digital transformation strategy that reflects a whole-of-government approach to policy making in the digital age.

Access



Communications infrastructures and services underpin the use of digital technologies, and facilitate interactions between connected people, organisations and machines. They serve as the basis for an open, interconnected and distributed Internet that enables the global free flow of information. Access to high-quality communication networks and services at competitive prices is fundamental to digital transformation. Data are emerging as a similarly vital resource. Data are a driver of economic activity and a general-purpose input into production in many contexts. Yet these benefits are predicated on data availability and accessibility. Enhancing access to and sharing of data is thus important, although such decisions should be balanced with considerations of data privacy and security, among others.

Access to communications infrastructures and services (e.g. fibre optic backhaul, towers, spectrum and international cables) are essential for digital transformation. This includes efficient, reliable and widely accessible broadband communication networks and services and key complementary enablers (e.g. a co-ordinated system of international domain names, increasing uptake of IPv6[3] Internet addresses, and Internet exchange points (IXPs)). Together, these elements form the technical foundation for an open, interconnected and distributed Internet that enable digital transformation (OECD, 2011[6]). Multiple policy domains need to be considered to ensure access including: communications infrastructures and services, competition, investment and regional development.

Governments can boost access by promoting ***investment*** in communications infrastructures, especially broadband networks, by encouraging the deployment of more fibre into networks to drive a substantial increase in speeds across technologies (see Box 1). Across the OECD, the greatest share of investment in communications infrastructures and services comes from the private sector. To spur private sector investment in networks, policy makers should address barriers to investment and improve competitive dynamics.

Box 1. OECD Guidance on Access

OECD Recommendation of the Council on Broadband Development (2004)

The OECD Recommendation of the Council on Broadband Development outlines a set of policy principles to expand broadband markets, promote efficient and innovative supply arrangements, and encourage the effective use of broadband services. It recognises the role of the private sector in facilitating the expansion of communications infrastructures and development. Importantly, the Recommendation underscores technological neutrality

among new technologies, underscoring the need for interoperability, innovation and choice in facilitating access in the digital age. This Recommendation will be revised in 2020.

OECD Recommendation of the Council on International Mobile Roaming Services (2012)

The OECD Recommendation of the Council on International Mobile Roaming Services presents a set of measures that aim to ensure effective competition, consumer awareness and protection, and fair prices in international roaming markets. These policy principles were developed in response to high wholesale charges for international roaming, which in turn had resulted in high retail charges. Since the Recommendation, significant progress has been made in reducing international mobile roaming prices through either regulation or increased competition.

Source: (OECD, 2004[7]) (OECD, 2012[8])

Many barriers to private sector investment relate to traditional ***communications infrastructures and services*** policy issues. For example, investment is often predicated on the availability or uptake of key technical enablers, including the existence of IXPs, spectrum and IPv6 addresses. For one, it is important to ensure the development of, access to and use of IXPs to keep traffic local, unburden interregional links and stimulate investment in local networks. Second, it is important to ensure efficient allocation of spectrum, a scarce natural resource that is increasingly important with the large amounts of data transmitted over wireless networks (OECD, 2014[9]). Third, as the pool of existing unassigned Internet Protocol (IPv4) addresses is close to exhaustion, the relatively slow uptake of the new generation of addresses (IPv6) could limit the connection of more devices (OECD, 2014[10]) (Ayoub et al., 2019[11]). Although some Internet service providers have developed short-term solutions for IPv4 reuse, long-term failure to move towards IPv6 could impact the evolution of mobile telephony and the Internet of Things (IoT), and could stymy efforts to reduce digital divides.

Communication infrastructures and services policies are crucial to foster high-speed infrastructure deployment. For example, simplifying license requirements, removing regulatory uncertainty and facilitating efficient access to rights of way can help to spur investment. These regulatory issues may gain increased significance in light of next generation wireless networks ("5G") (OECD, 2019[12]). In some countries, a lack of related infrastructure (e.g. electricity, roads and ports) can act as a significant barrier to investment. Removing undue restrictions on foreign investment can also spur investment in infrastructure (see Box 2 and Market Openness).

Policy makers should also aim to boost ***competition*** in communications infrastructures and services markets to spur private investment and help to deploy fibre further into fixed networks to support increases in speed and capacity across all next-generation technologies, including 5G networks (OECD, 2019[12]). The degree of competition among infrastructure and service providers influences investment and pricing decisions and can drive up the overall quality and speed of broadband offers, including to underserved populations.

Competition becomes even more important as broadcasting and telecommunication networks converge towards IP-based networks. Competition policies should ensure that users benefit from greater choice in services from network and service providers, either through bundled or simple voice, data and video offers. The effects of convergence on competitive conditions in communication networks in the long-term are not clear-cut. While the desire to offer several combinations of telephone, broadband Internet access,

wireless services and television is driving increased merger and acquisition activity between cable network operators and mobile network operators (MNOs) across the OECD (OECD, 2017[13]), new entrants have also entered communication markets in recent years (OECD, 2019[1]).

Policy makers should exercise caution with potential mergers that would reduce the number of MNOs in a given market, including by considering analytical studies on the price and non-price effects of such mergers. This is because experience has shown that countries with a larger number of MNOs, for example those going from three to four operators, are likely to offer more competitive and innovative services (OECD, 2014[14]), although local conditions vary. Proposed remedies should be assessed in terms of whether they effectively ensure competition. Some countries have opted for behavioural remedies such as obtaining commitments from merging parties, while others have facilitated the presence of mobile virtual network operators. Still others have applied structural remedies (e.g. divestment) when other options have been deemed not effective enough to promote competition. Policy makers should also promote sufficient competition in international mobile roaming (Bourassa et al., 2016[15]).

In addition, policies should support access to passive infrastructures deployed by other actors, particularly in markets characterised by a dominant market player. This can relate to operators deploying fibre to gain access to the infrastructure of public utilities, such as railways and energy companies, municipal facilities, or new entrants seeking access to passive infrastructures owned by other operators (e.g. dark fibre, ducts and masts). Infrastructure-sharing provisions like these should reduce costs for network and service providers while enabling the development of new and innovative services for end users (OECD, 2017[13]). Network sharing and co-investment represent other strategies that have been used by providers to increase infrastructure deployment (OECD, 2017[13]).

Notably, as broadcasting and telecommunication networks converge towards IP-based networks, there is some evidence to suggest that the relationship between competition, innovation and investment are changing (OECD, 2017[13]). Competition between communication networks and service providers generally leads to greater consumer choice, better quality communication services and lower prices. However, some argue that over-the-top (OTT) provision of voice and video services discourages infrastructure operators from investing in further network expansion and content creation. Others believe that it spurs innovation and competition in communication markets, and generates traffic and demand for broadband services, thus encouraging more investment. Policy makers should promote neutral frameworks that foster investment in broadband networks, protect consumers, promote competition and enable opportunities for all (OECD, 2016[16]). Competition policies for communications infrastructures may also need to be assessed in relation to its implications on the OTT applications and the services that depend on them (OECD, 2016[17]).

In some markets, there is no longer one single entity that provides all communication infrastructures and services. Rather, there are different models for providing connectivity that are emerging and are likely to have diverse implications for policy making. This raises the question of what communication operators – fundamental pillars of digital transformation – may look like in the future (OECD, 2019[18]). Due to convergence, the different types of operators are changing their business models, service offerings and technologies, and are competing in an increasing number of markets.

Innovation and competition are also important for addressing digital divides through ***regional development*** policies, namely the differences in access to broadband across

geography for rural and remote areas. This is a fundamental challenge created by physical distance from core networks, and can give rise to natural monopolies because areas of low population density may have high barriers to market entry, or pose low returns on investment.

Most OECD countries have established broadband access targets, and the majority of OECD countries have included specific initiatives to expand broadband in rural areas within national broadband plans (OECD, 2018[19]). These national broadband plans can also include specific provisions for public investment in communications infrastructures in rural areas, as speed and universal coverage priorities may be prioritised more highly by the public sector than the private sector.

Governments may more easily take a longer-term and broader view of returns, including positive societal externalities. Governments may choose to solve critical bottlenecks to private operation in rural areas by investing in high-speed backbones or backhaul infrastructures (OECD, 2017[20]), albeit often with the proviso of implementing open access policies so as not to encourage monopoly power in underserved areas (OECD, 2017[21]).

Given scarce public resources and the potential to crowd-out commercial rollout of high-speed networks, another option is to encourage private investment through a variety of incentives that reduce the cost of investment and network deployment in rural areas. Such incentives include competitive tendering for partial tax exemptions, lower spectrum fees, or loans at a reduced interest rate (OECD, 2018[19]). Innovative hybrid approaches using satellite broadband technologies also have potential for improving access in rural and remote areas (OECD, 2017[21]).

Policy makers should widely consider the best approaches and technological options to enhancing access in rural and remote areas, particularly when public funds are involved or decisions need to be taken over scarce resources like spectrum allocation. Before committing public funds, an *ex-ante* assessment should be carried out to understand the effects of public intervention on overall benefits, innovation, competition and market structure; legacy network arrangements and interest from private actors should also be considered.

Alongside communications infrastructures, access to data that flows through such infrastructures is increasingly important because data is a key source of value. Effective and innovative use and re-use can spur economic and social benefits ranging from innovative applications to increased transparency and accountability. However, these benefits are predicated on the availability of data. As a result, enhancing access to and sharing of data is a critical policy concern in the digital age (OECD, 2019[22]).

Allowing access to and sharing of data requires "openness", which can be thought of as a continuum of different degrees, ranging from closed (access only by the data controller) to discriminatory (access by stakeholders) to open (access by the public). In principle, all types of data can be shared or accessed for reuse, but not under the same conditions; there is no single optimal level of data openness. Ultimately, the optimal level of openness for any given dataset depends on its characteristics, including with respect to its domain, security considerations and the relevant legal and cultural environment.

Importantly, data are not homogenous, and their value often depends on their context. As some data can be personally identifiable or have the potential of misuse or misinterpretation, enhancing its access requires a careful consideration of issues relating to digital security, privacy and the protection of consumers and workers. Consequently, differentiated approaches are needed to minimise risk when enhancing access data while

minimising the costs. As digital transformation continues apace and data continue to be created exponentially as a result of more connected interactions, policy makers will find increased need to consider approaches of enhancing access to data.

Box 2. Access Policy Practice: Fostering competition to increase access in the Mexican telecommunication sector

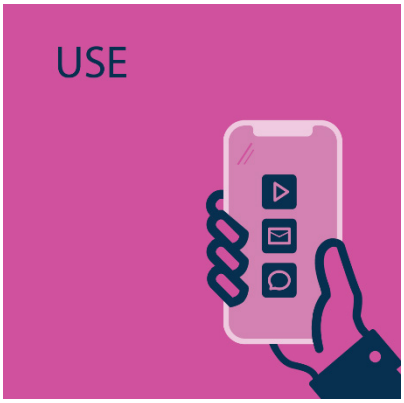
Increasing access to telecommunication services for consumers is the first step for enabling economies and societies to benefit from digital transformation. Nearly 50% of the global population is still offline and unable to fully participate in the digital economy. Increasing access, including for the disadvantaged, often calls for an increase in competition among infrastructure and service providers to improve the quality of service of communications services and to bring down prices for consumers.

In 2012, the Mexican telecommunication sector was characterised by a high degree of concentration and high average prices for telecommunication services. A single company controlled 80% of the landline phone market in Mexico and 70% of the wireless market, while over three quarters of households lacked access to the Internet. A review of the sector recommended 31 actions to improve competition in the telecommunication market, ensure the consistent and transparent application of telecommunication regulation, improve the legal and regulatory framework and stimulate competition more broadly throughout the economy (OECD, 2012[23]).

A subsequent review in 2017 found that increased competition resulting from the reform helped to drive down prices for telecommunication services in Mexico. The OECD high-usage basket, for example, had the sharpest drop in prices, from 101 USD PPP to 24.93 USD PPP, representing a decline of over three quarters of the original price. Almost 50 million mobile broadband subscriptions have been added since the reform, most of them with higher quality offerings than before. This decline in prices and increase in the quality of telecommunication services especially benefitted lower income households and disadvantaged communities and individuals throughout Mexico. Foreign entry into the marketplace has spurred investment in infrastructure and the *Red Compartida* – a shared wholesale wireless network – will likely further this trend.

Source: (OECD, 2012[23]).

Use



KEY POLICY DOMAINS

- Digital government
- Investment
- Business dynamism
- Small and medium enterprises
- Skills
- Digital security and privacy

Harnessing the power and potential of digital technologies depend on how they are used. Effective use enables individuals to participate in society, firms to boost productivity, and governments to go digital and adopt a user-driven approach. Widespread diffusion and effective use of digital technologies and data require awareness of the opportunities they bring, business dynamism, investment in information and communication technologies (ICTs) and complementary assets, skills in particular. At the same time, policies need to strengthen trust in digital environments, for example by empowering people and organisations to better manage digital risk. As such, the policy domains that need to be considered to foster effective use include: digital government, investment, business dynamism, small and medium sized enterprises (SMEs), skills and digital security and privacy.

Simple Internet use among individuals is widespread across the OECD, but the share of those using more advanced applications declines with the degree of sophistication and the growing need for higher skills to fully benefit from these activities (OECD, 2017[13]). For example, while over 70% of individuals use email and search for product information online, less than 40% engage in digital content creation and use cloud computing (OECD, 2019[1]). Important factors influencing usage are education levels, age, employment status, income and gender. For example, the usage gap between high and low educated individuals is over 40 percentage points for Internet banking. Large differences also persist across countries. For example, in the use of Internet banking, there is a gap of over 80 percentage points between the country with the highest and the lowest usage rates (OECD, 2019[1]).

Governments and the public sector also benefit from the use of digital technologies. While most OECD countries have digitised some aspects of public service delivery (e.g. public procurement and tax collection), large cross-country variations persist and potential remains for more advanced digital public services. Wider uptake of such services often requires digital enablers such as e-IDs or e-signatures. Efficient government processes and effective public services rely on interoperable digital solutions and data sharing, which can be enabled by the use of common standards and facilitated through horizontal and vertical co-ordination across different bodies and levels of government and public administration.

Going beyond e-government and the focus on digital service delivery, many countries are now shifting to the more holistic approach of ***digital government***. A core principle of digital government is to leverage digital technologies more fully for a user-driven approach, i.e. to design, develop, deliver and monitor public policies and services centred around people and user needs (citizens and businesses), rather than based on top-down assumptions

(OECD, 2018[24]). In digital government, digital technologies are not only used to digitise analogue processes and services, but as an opportunity to fundamentally rethink and reorganise government processes, procedures and services to make them digital by design, and involve people's preferences and user needs as drivers of change. In line with this approach, countries are increasingly adopting a "mobile first" approach to digital government.

Digital government strategies are a useful tool to adopt a more comprehensive approach to digital transformation of the government and the public sector (see Box 3, Innovation and Society) (OECD, 2014[25]). For example, digital government strategies can help to better integrate digital technologies in decision-making processes, shape strategic agendas, involve stakeholders, and contribute to more effective and efficient regulatory reforms. A digital government strategy should also address cross-cutting challenges governments face when going digital and help put in place key enablers of digital transformation.

Box 3. Policy Guidance on Use

OECD Recommendation of the Council on Digital Government Strategies (2014)

The OECD Recommendation of the Council on Digital Government Strategies lays out a framework for the use of digital technologies and data by governments that increase the inclusiveness, openness and transparency of government processes and operations. The Recommendation outlines in particular a set of policy principles that focus on the need to take steps to address existing digital divides and avoid creating new ones, to encourage the engagement and participation of public, private and civil society stakeholders in policy making and public service design and delivery, and to open up open government data.

G20/OECD High-level Principles on SME Financing (2015)

The principles aim to support the efforts of G20 and OECD members and other interested economies in enhancing access to a diverse range of financing instruments by SMEs, including micro-enterprises, and entrepreneurs. The G20/OECD High-level Principles on SME Financing include eleven principles: 1) the identification of SME financing needs and gaps and improvement of the evidence base; 2) the strengthening of SME access to traditional bank financing; 3) the enabling of SMEs to access diverse non-traditional bank financing instruments and channels; 4) the promotion of financial inclusion for SMEs and easier access to financial services, including those in the informal sector; 5) the design regulation that supports a range of financing instruments for SMEs, while ensuring financial stability and investor protection; 6) the improvement of transparency in SME finance markets; 7) the enhancement of SME financial skills and strategic vision; 8) the adoption of principles of risk sharing for publicly supported SME finance instruments; 9) the encouragement of timely payments in commercial transactions and public procurement; 10) the design of public programmes for SME finance which ensure additionality, cost effectiveness and user-friendliness; and 11) the monitoring and evaluation of public programmes to enhance SME finance.

Source: (OECD, 2014[25]); (G20/OECD, 2015[26]).

In the private sector, a large share of firms across the OECD is connected to the Internet and make use of basic digital tools; yet many are still not using more advanced tools and lack high-quality broadband. For example, significant scope remains for firms to use digital tools for market integration (e.g. e-purchases, e-sales, social media and supply chain

management software), for business processes and organisation (e.g. enterprise resource planning software, customer relationship management software and cloud computing) and for the IoT (e.g. radio frequency identification). A key tool for which much potential remains is big data analysis, which only 11% of firms perform so far (OECD, 2019[1]). While such digital tools can drive innovation and productivity, they are particularly underused among SMEs, which tend to lack awareness of digital opportunities and the capacity to take risk and invest.

Unleashing the potential of digital tools for firms to increase productivity requires successful diffusion. Recognising the limitations of a linear technology diffusion model of the past, approaches to boost diffusion should take into account not only the individual firm, but also their networks of suppliers, users and customers. Key actors, institutions and mechanisms for technology diffusion include government technology transfer offices, universities, other non-governmental stakeholders and test beds, which can help to manage the risks associated with prospective investments. Examples of diffusion measures used in different countries include industrial extension programmes, technology transfer, technology-oriented business services, applied technology centres, research and development (R&D) centres, knowledge exchange and demand-based instruments. In addition, networks, partnerships, and open source collaborations are increasingly important in fostering diffusion (OECD, 2017[27]).

Digital technology diffusion crucially depends on firms' ***investment*** in ICTs as well as public investment in infrastructure and equipment. For example, investment in high-speed broadband infrastructure positively affects the adoption of digital technologies (Andrews, Nicoletti and Timiliotis, 2018[28]). Effective use of technologies further requires investment in complementary assets, knowledge-based capital (KBC) in particular, including R&D, data, design, new organisational processes, and firm-specific skills. While the nominal value of ICT investment as a share of GDP for computer hardware and telecommunication equipment decreased between 1999 and 2015, investment in software and databases increased by 44% over the same period (OECD, 2019[1]). In many countries, investment in KBC exceeds investment in physical capital.

Countries are promoting ICT investment through a variety of policy measures. In addition to monetary support or incentives for the purchase of ICT equipment or for ICT development, non-financial support is often provided through targeted training, mostly focused on the digitalisation of business services, e-commerce, or the effective use of digital media (OECD, 2019[29]). Other approaches used across OECD countries include, in the order of frequency: 1) measures to facilitate data (re)use across organisations and sectors, 2) promotion of e-health applications and e-commerce, 3) digital content creation and diffusion and 4) measures to foster the uptake of the IoT and machine-to-machine (M2M) communication (OECD, 2017[13]).

Technology diffusion is also linked to ***business dynamism,*** which depends on efficient resource allocation. The digital transformation of firms involves experimentation and learning, with some firms successfully adopting digital tools and rapidly scaling-up and others scaling-down or exiting the market (Andrews and Criscuolo, 2013[30]). On the one hand, business dynamism is higher in digital-intensive sectors, exhibiting higher entry rates and higher job reallocation rates than other sectors, which is consistent with the idea that digital technologies lower entry barriers and tend to facilitate reallocation (Calvino and Criscuolo, 2019[31]). On the other hand, business dynamism has been declining over the past decade in many OECD countries (Criscuolo, Gal and Menon, 2014[32]), and particularly fast in digital-intensive sectors (Calvino and Criscuolo, 2019[31]), while

resource misallocation is on the rise (Adalet McGowan, Andrews and Millot, 2017[33]); (Berlingieri, Blanchenay and Criscuolo, 2017[34]).

Business dynamism can benefit from structural reforms. Existing frameworks may implicitly or explicitly favour incumbents and hinder experimentation with new ideas, technologies and business models that underpin the success of small and large firms. Policies that can affect competitive pressure and business dynamism, and in turn technology diffusion and better resource allocation, include: labour market regulations, employment protection legislation, and the design of insolvency regimes, e.g. less penalising sanctions for bankruptcy and lower barriers to corporate restructuring of insolvent firms (Andrews, Nicoletti and Timiliotis, 2018[28]); (Adalet McGowan and Andrews, 2018[35]); (Sorbe et al., 2019[36]).

Effective use of digital tools is increasingly essential for ***SMEs*** to improve business processes, to innovate, to scale up and to internationalise. However, SMEs are lagging behind large firms in the adoption of digital tools and in particular in the use of advanced ones. Key barriers include a lack of awareness, missing collateral that is needed to take risk and to access finance for investing in ICTs and complementary assets, and a lack of human resources and capabilities, e.g. ICT specialist and management skills. Resulting shortages of investment in in-house innovation and organisational capabilities can severely limit SMEs' propensity to create value with digital tools such as big data analysis, engage in e-commerce and participate in knowledge networks.

To help SMEs overcome these barriers, governments need to support and better target policies to SMEs. Such policies include: 1) support schemes to facilitate the adoption of tools that are particularly beneficial and may be new to SMEs (e.g. cloud computing); 2) measures to help SMEs overcome obstacles to better exploit and protect intellectual property (IP); 3) exemptions of certain rules for SMEs to facilitate regulatory compliance; and 4) programmes that raise awareness of and create opportunities for linkages and partnerships between SMEs and larger firms, domestically and internationally, to help SMEs to exploit their potential in producing intermediate goods and digital services (OECD, 2019[1]). Policies targeting firms by size should avoid creating disincentives for SMEs to scale up.

Finally, technology diffusion and effective use crucially depend on investment in ***skills*** (Andrews, Nicoletti and Timiliotis, 2018[28]). The success of firms in the digital era not only depends on workers with good literacy, numeracy, problem solving, and generic ICT skills[4] used at work[5], but also increasingly requires ICT specialists[6] and data specialists[7]. In addition, firms increasingly require complementary skills and competences[8] for new organisational forms and in digital-intensive sectors. Meeting these needs is particularly challenging for SMEs and laggard firms, notably in certain sectors, including the public sector, which tend to face steep competition for skills (OECD, 2017[37]). Many of these skills are not only crucial for firms to thrive, but more generally important in a digital world of work (see Jobs) and in a digital society (see Society).

Ensuring long-term provision of relevant skills for the digital age requires a fresh look at and investments in ***education***. In addition to the central role of primary education to ensure sound literacy and numeracy skills, students need options for developing ICT and complementary skills, including social, communication and management skills. Such skills might be the subject of tertiary education as well of vocational and technical training. Different types of education can in principle benefit from using digital technologies; however experience so far shows that positive outcomes seem to depend on how technology is integrated in and associated with teaching practices (OECD, 2019[38]).

For more immediate returns to investment in skills, training is crucial. Whether publically or privately provided, taken externally or on-the-job, firms and workers need incentives to provide and take more and well-targeted training. Low-skilled workers are often the ones that are most in need of training, and training such workers is likely to entail a double dividend for productivity and inclusiveness (Sorbe et al., 2019[36]). Importantly, in view of uncertain future skill requirements, education and training policies and providers need to co-ordinate with industry and social partners to better design and target training, and to improve the matching of skills demand and supply (see Box 4).

Box 4. Use Policy Practice: The Portuguese National Initiative on Digital Competences 2030

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

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

INCoDe.2030 includes several initiatives to promote digital competences. It enables citizens to benchmark their level of skills and identify knowledge gaps on a dynamic framework based on the European initiative DigComp 2.0. Specific programmes are designed to target vulnerable groups, including via a freely accessible online training platform. Other elements of the programme include life-long learning and active labour market programmes to help displaced workers integrate in a dynamic labour market.

Source: (INCoDe.2030, 2019[39]).

Besides established approaches to education and training that might not always fit all firms and individuals in all circumstances, digital technologies can be used for more flexible up- and re-skilling options, for example massive open online courses (MOOCs). While over the past decade MOOCs have emerged as a widely accessible and affordable distance-learning tool that is applicable in multiple domains, a key to making digital learning more effective are certifications that recognise skills independently from years of completed education (OECD, 2019[38]). Micro-credentials, for example, could help complement conventional skills certification. Also needed are efforts to better recognise tacit knowledge that may be acquired on-the-job or through online tutorials.

Finally, the use of digital technologies is fundamentally underpinned by trust, which is essential for digital interactions and transactions to take place. Mistrust in turn can be an important barrier to diffusion and effective use. In particular, concerns about ***digital security*** and ***privacy*** can severely hamper individuals' propensity to carry out online activities (OECD, 2019[1]). For businesses as well, trust is a key factor affecting the adoption and use of digital tools. For example, the risk of a security breach and uncertainty about the location of stored data are key reasons for businesses not to use cloud computing, which translates into low uptake, notably among SMEs. Governments may also face

privacy issues, for example, when linking data sets or when opening up government data to the public (see Innovation). Addressing these barriers requires all actors to better manage digital risk, i.e. build capacities to assess digital risk and reduce it to an acceptable level, including through risk mitigation and/or transfer (see Trust).

Innovation



Digital innovation is a fundamental driver of digital transformation, leading to profound changes in the ways people interact, create, produce and consume. Digital innovation not only gives rise to new and novel goods and services, but it also creates opportunities for new business models and markets, and it can drive efficiencies in the public sector and beyond. Digital technologies and data spur innovation in a wide range of sectors, including education, health, finance, insurance, transportation, energy, agriculture, fisheries and manufacturing, as well as the ICT sector itself. Multiple policy domains need to be considered to foster innovation: entrepreneurship and SMEs, science and technology, competition, digital government, and sectoral policies such as energy, finance, education, transport, health and education, among others.

Effective use of digital technologies and data analytics underpin digital innovation and new business models, and are often associated with changes in innovation processes and outcomes as well as higher innovation performance across the economy (Guellec and Paunov, 2018[40]) (see Use). Innovation dynamics are particularly strong in the ICT sector, which has a high share of small and young businesses that also tend grow faster (OECD, 2017[41]).

Young firms are an essential part of the digital innovation landscape, so promoting digital innovation requires a focus on ***entrepreneurship and SME*** policies that encourage the emergence and growth of new and young firms. Young firms create a disproportionate number of jobs relative to their size, underpin broader economic growth across the economy (Criscuolo, Gal and Menon, 2014[32]); (Calvino, Criscuolo and Menon, 2016[42]), and may have a comparative advantage in commercialising new technologies (Henderson, 1993[43]). A high share of young firms spur productivity-enhancing reallocation within sectors as resources flow from inefficient laggards to smaller, dynamic enterprises, enabling them to grow faster.

Helping entrepreneurs start innovative businesses also requires attention to structural factors that facilitate new ventures and do not excessively penalise entrepreneurial failure (Adalet McGowan, Andrews and Millot, 2017[33]). In addition, organisations need to invest in KBC, which is essential for innovative business models and new organisational forms that raise the premium associated with complementary skills (see Use and Jobs).

Smaller firms, however, may have reduced capacity to take the risks to pursue digitally-driven business models or adopt innovative digital technologies. Start-ups tend to face difficulties accessing asset-based and traditional debt financing, and those who receive such financing often pay higher transaction costs than their incumbent rivals (OECD, 2015[44]).

Increasing the range of financing options and reducing the debt bias of corporate tax systems is thus important. Digital technologies can also help to improve SMEs' and start-ups' access to finance through innovative instruments like crowdfunding (OECD, 2019[45]). In addition, venture capitalists can help bridge the financing gap that arises from the fact that early adopters of digital technologies – often young firms – lack internal funds and a track record to signal their "quality" to investors (Hall and Lerner, 2009[46]).

Market concentration in a digitalised economy can represent another barrier to innovation, underscoring the importance of ***competition*** policies. Young firms serve as important sources of competition for other, established firms, and can spur economy-wide innovation. Larger firms have significantly increased their acquisitions of start-ups from more digital-intensive industries. In particular, the data processing and software publishing sectors saw a very large increase in the acquisition of data processing start-ups between 2005 and 2016, such that the top 1% of acquirers accounted for about 70% of total deal value in 2016 (Bajar et al., forthcoming[47]).

Regulatory frameworks can constrain the entry of new players, which is essential for driving competition, innovation and technological diffusion across the economy. For example, regulations that require a physical presence can constrain the emergence of online intermediary businesses (OECD, 2018[48]). Regulations that mandate a large minimum scale can imply that only few digital enterprises would be able to reach such scale. Similarly, a high regulatory burden in some industries, such as banking, can be so high as to be only affordable for incumbent firms of a certain size, constraining the emergence of smaller, often digitally-enabled business models. Finally, some regulations that initially intended to address market failures related to information asymmetries (e.g. standardised star rating systems for hotels) may no longer be necessary to the degree that digital products (e.g. user-provided ratings and reviews) are able to distinguish quality.

Digital technologies enable the development of new goods, services and business models, such as scalable cloud computing services that facilitate the storage and processing of data remotely, removing the need for users to invest in ICT infrastructure and maintenance, and providing flexibility to scale up or down such services. As digital transformation continues to progress, new business models and products will develop in ways that are difficult to predict, highlighting the need for a degree of regulatory flexibility in tandem with the enforcement of existing standards and regulations.

Digital innovation relies on continuously building the knowledge base, and basic research into ***science and technology*** is critical in this respect. Support for universities and other institutions conducting basic research can help sow the seeds of future innovation; indeed, basic research has underpinned most of the general-purpose technologies that drive the current phase of digital transformation (OECD, 2015[49]); (OECD, 2015[50]). The public sector plays an important role in supporting such research since the private sector is often reluctant to invest in projects where the costs are high and the returns are uncertain. For example, some of the earliest digital technologies, such as the Internet, the global positioning system (GPS) and voice recognition technology, are the result of extensive public research and development efforts.

The public sector also helps drive innovation beyond research. Partnerships between universities, industry and government can also help provide start-ups with the know-how, equipment and initial funding to test and scale new technologies. Public-private partnerships (PPPs) also spur innovation by sharing both the risks and rewards of digital innovation. In many fields of advanced production, innovation in the business sector is closely linked to the science system and the process of discovery. Few individual

companies – even the largest – have the full range of resources needed to advance the knowledge frontier alone. This reality has led to increasingly sophisticated PPPs aimed at generating and diffusing cutting-edge science and innovation. PPPs can also spur the commercialisation of research (OECD, 2018[51]).

Well-designed incentives to support R&D and innovation can be helpful in this regard, including the protection of intellectual property regimes (IPRs) and tax-based incentives such as R&D tax credits. Ensuring the impacts of such investments also requires efforts to foster knowledge diffusion across the economy, including by strengthening exchanges between science and business. New models are emerging, including online platforms that enable access to research infrastructures supporting science (OECD, 2017[52]).

Open science initiatives can also be useful for boosting digital innovation (OECD, 2015[53]). Such initiatives promise greater access to scientific information and data sharing, as well as more effective engagement of businesses, policy makers, citizens and other interested parties involved in public research. Indeed, the process of research itself has changed as a result of digital transformation. Digital technologies like artificial intelligence (AI) hold promise for observation, hypothesis generation and experimentation. AI also facilitates the automation of tasks previously conducted by scientists, including the observation and collection of data. Some AI applications, particularly those analysing semantics using natural language processing, have been developed to sift and parse the growing mass of scientific literature, thereby enabling more focused research for scientists (Extance, 2018[54]).

Ultimately, such initiatives should lead to more efficient and effective science, accelerated innovation and new knowledge and technologies that drive social and economic development. However, fully realising the potential benefits of open science will require judicious policy action and careful management of expectations and risks (OECD, 2016[55]); (Dai, Shin and Smith, 2018[56]). New challenges related to ethics and the preservation of quality and safety standards may also need to be addressed.

Innovation in the digital era is increasingly data-driven. Data and data analytics are spurring changes in existing business models at the same time that they enable entirely new ones. Data-driven business models often build on the collection and analysis of enormous amounts of data, for example on consumer behaviour, which provides useful insights that can be used to better market or customise products and improve decision making or processes. Many firms with an online presence, from stockbrokers to Internet search firms, can further automate their core functions based on data-driven insights.

The importance of data and data analytics as a source of innovation has been increasingly recognised by policy makers and statistical offices. Recently, the 4th edition of the *Oslo Manual*, which outlines the international statistical standard for the measurement of innovation, recognised software development and database activities among eight broad types of activities that firms can undertake in pursuit of innovation (OECD/Eurostat, 2018[57]).

Digital government strategies, and open government data in particular, can drive innovation and efficiencies in the public sector and beyond. Digital technologies can help governments to better develop, design and enforce policies and regulations, become more efficient and reduce waste. As the public sector both produces and consumes large amounts of data, there is significant potential for governments to use this data and digital technologies to innovate (Box 5).

Box 5. OECD Guidance on Innovation

OECD Innovation Strategy (2015)

Innovation underpins growth and dynamism of all economies, and provides a foundation for new businesses, new jobs and productivity growth. The updated OECD Innovation Strategy (2015) sets out five policy priorities: 1) strengthen investment in innovation and foster business dynamism, 2) invest in and shape efficient systems of knowledge creation and diffusion, 3) seize the benefits of the digital economy, 4) foster talent and skills and optimise their use, and 5) improve the governance and implementation of policies that promote innovation. The Innovation Strategy underscores that a mix of policies, which will vary depending on the context and go beyond narrowly defined research and innovation policies, are needed to promote innovation. It also highlights the importance of monitoring and evaluation, learning from experience, and adjusting policies over time to ensure that government action is efficient and reaches its objectives at the least possible cost.

Principles on data openness and sharing

Ongoing work at the OECD aims to identify common principles relating to data openness and sharing. Relevant OECD instruments in this respect include the OECD Recommendation of the Council Concerning Access to Research Data from Public Funding (2006), the OECD Recommendation of the Council for Enhanced Access and More Effective Use of Public Sector Information (2008) and the OECD Recommendation of the Council on Digital Government Strategies (2014). The aim is to develop an overarching OECD legal instrument that combines general principles of enhanced access to and sharing of data. This instrument, when developed, will have implications for Access, Innovation and Developing a Digital Transformation Strategy, as discussed in this report.

Source: (OECD, 2015[58]); (OECD, 2006[59]); (OECD, 2008[60]); (OECD, 2014[25])

The pace of digital transformation varies across ***sectors***. Using data on a range of technological, investment and human-capital related features, the OECD developed a taxonomy that outlines the extent to which different industries have gone digital. This taxonomy (Calvino et al., 2018[61]) shows that while almost no business today functions without some form of digital technology, only some sectors are highly digital-intensive so far.

Perhaps unsurprisingly, the ICT sector and the telecommunication sector appear to have incorporated digital assets and know-how across the breadth of their businesses, although ICT services outstrip their manufacturing counterparts. Others show significant heterogeneity across indicators, pointing to different degrees of digital intensity. Looking ahead, digital technologies (e.g. data analytics and AI) offer vast potential to improve productivity in service activities, including in less knowledge intensive activities (e.g. personal transport, accommodation) where productivity has traditionally been sluggish (Sorbe, Gal and Millot, 2018[62]).

In the health sector, for example, connecting historical patient data with real-time patient data, and using connected devices, could drive increasingly personalised care and sector-wide innovation, including through better measurement of treatment costs and better detection of unsafe practices, fraud and waste in the healthcare system. However, so far,

many potential benefits of digital transformation of the health system have been hindered by fragmented data governance systems (Oderkirk, 2017[63]).

In other sectors, like agriculture, digital technologies such as geographical information systems and increasingly detailed data about soil, weather and environmental conditions can help to optimise the agricultural production process (OECD, 2019[64]). These data can then be reinvested for further analysis, including in new software and technologies that enable further integration up and down the agricultural value chain.

In education, large investments have been made in the use of technologies at school and at home to enhance educational outcomes for students. Digital transformation creates significant opportunities, from enhancing access to knowledge to facilitating new skills development. However, potential benefits appear to depend on whether digital tools are used as substitutes or complements to traditional education (Bulman and Fairlie, 2016[65]); (Escueta et al., 2017[66]). At school, for example, computer use seems to have greater positive effects on students' educational outcomes when supplemented with additional hours of instruction, and when teachers are skilled to deploy digital tools effectively.

Box 6. Innovation Policy Practice: Digital innovation in cities

In 2014, almost half of the OECD population lived in urban areas (OECD, 2016[67]). Cities increasingly concentrate knowledge-intensive activities, including lucrative tradeable service sectors strongly associated with digital transformation (OECD, 2018[68]). In turn, cities feature highly skilled workers and the firms that seek them. The density of many cities as well as the associated suburban areas connected to them also facilitate clustering of a large diversity of people and services, facilitating knowledge spillovers and driving agglomeration economies that can improve productivity.

However, the increasing urban population and economic significance of cities places new demands on urban infrastructures and effective service delivery. Improving the functioning of cities through digital innovation has been touted as a possible solution to this policy challenge, through the conceptual rise of "smart cities", "empowered cities" and other movements. Cities also act as a nexus for a variety of different policy domains, from sectors like transport, health, energy and water, but also different tiers of government and public agencies.

The potential for digital innovation in cities is immense. High-quality infrastructures, including high-speed communications infrastructures, are the basis for such innovation to flourish. Embedding sensors to connect devices across infrastructures could enable better measurement, for example of how people and things move across the city. These data could facilitate matching supply and demand and drive more efficient capacity utilisation.

For example, Amsterdam is implementing various digital and data-driven applications throughout its urban systems. There are currently 80 ongoing projects in areas related to infrastructure, energy, waste, water, mobility, governance and citizens (Macpherson, 2017[69]). Many of these projects also make use of synergies between disparate systems, an often unrealised source of efficiencies for so-called "smart city" projects (OECD, 2015[50]).

One project in Amsterdam uses digital technologies to connect previously disparate energy, transport and public infrastructures to energy supplies through electric vehicles. The local electricity network in Amsterdam districts have been embedded with connected devices and sensors at key nodes, enabling reliable and remote monitoring and management and local energy trading (for example, selling excess solar electricity to others on the grid). An

extension of this project is the integration of electrical vehicles, which can act as batteries to help regulate the fluctuating supply of renewable energies. A pilot project is ongoing which utilises bi-directional chargers and smart algorithms to dynamically distribute energy supply and storage (Macpherson, 2017[69]); (CityZen, 2017[70]).

The example of Amsterdam's efforts to innovate in the digital age underscores the need for co-ordinated and integrated policy making. A complex array of projects, partnerships and organisations are active in this space, including public utilities, public officials from all tiers of government and a public-private platform called the Amsterdam Smart City initiative (Fitzgerald, 2016[71]). These in turn intersect with initiatives from the European Union and those of academic institutions including a new research institute called the Amsterdam Institute for Advanced Metropolitan Solutions, which itself aims to co-ordinate public and private groups.

Source: (OECD, 2016[67]); (OECD, 2018[68]); (Macpherson, 2017[69]); (OECD, 2015[50]); (CityZen, 2017[70]); (Fitzgerald, 2016[71]).

Jobs



Digital transformation has already begun to change organisations and markets, raising important questions about which jobs might disappear and where new ones will come from, what they will they look like and which skills will be required. At the same time, issues around who might be most affected, and what can be done to foster new job creation and to align skills development with the changing skills requirement of jobs have emerged. Making sure that digital transformation leads to more and better jobs will depend on policies, including in the domains of labour markets, skills, social protection, and tax and benefits. Since impacts may be concentrated in some industries and regions, sectoral and regional development policies will be important, too.

Digital transformation leads to creative destruction, with some jobs being lost and others being created. Overall employment rates are at record high levels in many countries. Evidence on changes in total employment across the OECD between 2006 and 2016 shows that 42% or 16 million jobs of the net gain of about 38 million jobs were created in highly digital-intensive sectors (OECD, 2019[1]). This finding is in line with the theoretical assumption that in addition to direct job creation, investment in or use of ICTs should result in indirect job creation by contributing to rising productivity, lower prices and new products that lead to higher final demand and in turn employment (OECD, 2016[72]). The use of digital technologies also facilitates carrying out work via online platforms. Such jobs range from services delivered locally (e.g. mobility or accommodation) to services delivered online, including simple click-work, as well as high-skilled programming and consulting (OECD, 2016[73]).

Much attention has recently focused on estimations of the number of jobs that may be affected by automation in the future. While bounded by uncertainty, the OECD estimates that on average 14% of jobs face a high likelihood of automation and another 32% are likely to experience significant change over the next 10-20 years (Nedelkoska and Quintini, 2018[74]), implying that close to half of all jobs are likely to experience significant change. Viewed through the lens of skills, proficiency of literacy skills used daily at work by 62% of workers in OECD countries are found to be at a level that computers are already close to reproducing (Elliott, 2017[75]).

However, it is unclear how much of the likelihood of automation will actually materialise. In fact, there is no evidence that, to date, technological change has been associated with net job losses overall (OECD, 2017[13]). There seems to be a large gap between what can be automated from a technical point of view and what is currently being automated by firms. A host of factors can affect technology adoption, including skills, policy, and economic,

industry, legal, ethical and social factors; market forces driving the relative prices of capital and labour; market structure and the presence of big, medium or small firms in a location or industry; institutional norms and regulations; and consumer, societal preferences and ethical norms (OECD, 2018[76]). Robots might even help reduce job losses that occur through offshoring in some developed economies by decreasing the need for relocating certain activities (De Backer et al., 2018[77]).

Technological advances and the introduction of new business models have given rise to the "platform economy" and have led to the emergence of non-standard forms of work, carried out via online platforms, such as "crowd work", "gig work", and other forms of on-demand labour. While such new forms of work still represent a small share of employment, they appear to have grown fast in recent years (OECD, 2016[73]); (Schwellnus et al., 2019[78]) (OECD, 2019[79]). Most of such work seems to be carried out as some form of non-standard work, notably by independent, self-employed or own-account workers, many of which work part-time and some of which may be misclassified.

Workers in platform markets often benefit from low entry barriers and flexibility, which can facilitate the labour market integration of under-represented groups and may promote inclusiveness. However, labour market outcomes vary greatly across non-standard workers, in particular in terms of pay, job security and social protection. For example, own-account workers are significantly more likely than employees to earn less than the minimum wage (OECD, 2018[76]). Such workers are also less likely to be covered by collective bargaining arrangements and/or some labour regulations, tend to receive less training, and are exposed to more job strain. New forms of work add to the challenge of organising workers' voices since individuals are increasingly working alone, separated by geography, language and legal status or simple lack necessary information. Going forward, it is important to understand how to promote workers' representation in a world where flexible forms of employment may become more common.

Further growth of such non-standard work under current conditions may risk increasing inequalities. Given that certain population groups seem to be over-represented in non-standard forms of work (typically women, youth, the least-skilled, workers with disabilities, and workers in small firms as well as migrants), on-demand labour could become a new source of inequality in access to good jobs (with some groups confined to less attractive types of work) and contribute to labour market segmentation. In this context, it is important to avoid that such work results in a transfer of fiscal responsibilities from employers onto government and individuals, notably if firms use such forms of work to avoid employer and labour standards, tax and other financial obligations, and do not respect key principles of responsible business conduct.

The uncertainties linked to digital transformation and the structural changes it induces in labour markets need to be addressed by a policy agenda that puts people's well-being at the centre and ensures that nobody is left behind. To achieve this, the OECD Jobs Strategy provides guidance on how to improve labour market performance along three dimensions: 1) more and better jobs; 2) inclusive labour markets; and 3) adaptability and resilience. On skills development, the OECD Skills Strategy provides countries guidance on strategic imperatives and core areas of policy action (Box 7).

Box 7. OECD Guidance on Jobs

OECD Jobs Strategy (2018)

The OECD Jobs Strategy consists of a comprehensive set of policy recommendations to promote more and better jobs. Since its launch in 1994, it has become a key reference for guiding national labour market policies in Member and partner economies. The 2018 revision of the Jobs Strategy emphasises job quality and inclusiveness as central policy priorities, and highlights resilience and adaptability for good economic and labour market performance in a changing world of work. It recognises that policies aimed at increasing flexibility in product and labour markets are necessary but not sufficient. Policies and institutions that protect workers, including trade unions and social dialogue, foster inclusiveness, job quality and fair wages and allow workers and firms to make the most of ongoing challenges are also needed to promote good outcomes. The new Strategy also promotes a whole-of-government response, embedding the Strategy in the OECD Inclusive Growth Initiative.

OECD Skills Strategy (2019)

To develop a holistic approach to improving education and training systems, governments need to invest strategically. The OECD Skills Strategy provides an integrated, cross-government framework to help countries identify the strengths and weaknesses of their national skills systems, benchmark them internationally, and develop policies that can transform better skills into better jobs, economic growth and social inclusion. The OECD Skills Strategy identifies three strategic imperatives – 1) life-long learning; 2) fostering equitable opportunities and outcomes; and 3) making better use of digital technology as a learning device. It advocates for three core areas of policy action: 1) developing relevant skills across the life course; 2) using skills effectively in all facets of work and society; and 3) strengthening the governance of the skills system.

Source: (OECD, 2018[80]) (OECD, 2019[81]).

Adapting to transforming ***labour markets*** will require policies that facilitate a fair transition of workers across businesses, industries and regions. The success of such transitions will depend on the flexibility of firms and the mobility of workers, i.e. the ease with which entrepreneurs can start or liquidate a business, firms adjust their workforce in response to changing business conditions, and workers move across firms and places in search of better matches for their skills and to enhance their career opportunities. Labour and product market policies play a key role in allowing such flexibility by not unduly constraining the entry and exit of firms and allowing growth and job creation, and by fostering investments that promote the mobility of workers, including through initiatives by social partners to set provisions on lay-offs, foster life-long learning and adaptability, career guidance mechanisms and training funds. Worker mobility also depends to an important extent on the transferability of skills and the portability of benefits, availability of effective employment services, and active labour market programmes to facilitate job transitions.

Transitions into occupations at low or medium likelihood of automation seem to be possible for all workers, but not necessarily acceptable in that some transitions may entail important human-capital losses and/or wage cuts (Bechichi et al., 2019[82]). On the one hand, high-skilled workers move more easily from one job to the next than low-skilled workers, because cognitive skill distances[9] between different high-skilled occupations are smaller

than between different low-skilled occupations and between medium-skilled and high-skilled occupations (Bechichi et al., 2018[83]). On the other hand, the move of a high-skilled worker from a job at high likelihood of automation to a job at lower likelihood of automation is more costly than the same move of a low-skilled worker, because high-skilled workers' opportunity costs of leaving employment for training is higher than the opportunity cost for low-skilled workers (Andrieu et al., 2019[84]).

Maintaining and improving labour market performance in a digital world of work will also require a fresh look at labour market regulations. This includes employment protection legislation, minimum wage laws, working time regulations, and regulations to safeguard occupational health and safety, among others (OECD, 2019[85]). As digital transformation may further promote the diffusion of non-standard forms of work, this may result in reduced job and income security for such workers. For some of the emerging new forms of work, it is not clear what the status of workers is, who the employer is, and what rules should apply to them. It will therefore be critical for countries to examine their legal frameworks to determine whether they need to be updated and/or adjusted to remain fit for purpose so that all workers, regardless of contract type, receive adequate rights, including their freedom to association and bargaining, equal pay for equal work, benefits and protections.

Countries should also consider how existing regulations can be better enforced in the face of disruptive business models, and what complementary legal and regulatory measures can help. In some cases, employment regulation or its application will need to be clarified or adapted in view of new forms of work. For example, one challenge is that in some countries independent workers cannot unionise since this would be considered forming a cartel. In addition, labour market regulations and tax policy should be scrutinised to ensure neutrality between various forms of work and contracts and to avoid regulatory arbitrage.

To successfully navigate through ever-changing, technology-rich work environments, people need to prepare for future jobs by being equipped with the right mix of ***skills***. While uncertainty remains about the evolution of skill demand induced by digital transformation, the mix of crucial skills include literacy, numeracy, and problem solving skills, ICT generic skills, as well as complementarity skills and competences (many of which underpin high-performance work practices), such as creative thinking, team work, autonomy, task discretion, mentoring, management practices, communication, collaboration, emotional intelligence, and a strong ability to continue learning. Many new jobs, notably in ICT intensive sectors and occupations, further require ICT specialist and/or data specialist skills, for which demand is higher than supply in many countries (OECD, 2017[13]).

An effective response to these skill needs requires a holistic approach to skills development, from early childhood education to life-long learning. After initial education, all workers need to be given opportunities and incentives to maintain their skills and to upskill and/or reskill throughout their working lives, including both formal and informal learning. Barriers to adult education and training need to be addressed, especially for low-skilled individuals. Approaches include stronger incentives for investment in training (e.g. personal training accounts, or life-long training rights), mechanisms to allow the portability of training rights between employers, and measures that foster workers' motivation to learn and remove time constraints.

Policies also need to encourage employers to invest in training, as the scale of the challenge goes beyond the capabilities of the public sector alone. Governments can provide incentives for private investment in the development of transferable skills, build work-based learning into educational programmes, and create an environment where people have greater

discretion over learning activities. Online courses, such as MOOCs, also offer flexible and affordable options for distance learning in several areas; however, skills certification and recognition outside of formal education still pose a challenge (OECD, 2019[38]).

Not all workers who transition into new occupations or those that try to enter the labour market for the first time or after an unemployment spell will find a new job immediately. ***Social protection*** is thus crucial to enable successful and fair transitions for all, including displaced workers. This involves a system of well-designed and adequately resourced active and passive labour market programmes, providing workers timely access to basic job search services, and targeting the workers that require more intensive (re)employment services or retraining.

In a context where many countries already struggle to provide adequate social protection, workers on non-standard work contracts (e.g. temporary contracts, self-employed, on-call labour), including in online platform markets, add to these difficulties. An increasing number of people work only occasionally and/or have multiple jobs and income sources, with frequent transitions between dependent employment, self-employment and work-free periods. Many people work informally and are not protected under existing rules. All this is adding to the challenges faced by existing social security systems, which are still largely predicated on the assumption of a full-time, regular, open-ended contract with a single employer.

Tax and benefit systems also need to be extended and/or adapted to ensure that all workers are provided with minimum protection and that their various sources of income are brought into the tax system. Portability of social security entitlements should be promoted to prevent the loss of benefit entitlements when workers move between jobs. Governments may also need to expand the role of non-contributory schemes so that no one is left without social protection as a result of their contract status.

Anticipating future challenges and opportunities, finding solutions, managing change proactively, and responding to evolving skill needs can be achieved more easily and effectively through social dialogue with education and training institutions, employers, trade unions and workers' representatives working closely together with governments in a spirit of co-operation and mutual trust (see Strategy). A good example of social dialogue and co-operation between social partners can be found in Sweden, exemplified by the Swedish Job Security Councils (Box 8).

Box 8. Jobs Policy Practice: Job Security Councils in Sweden

In Sweden, the labour market is characterised by a high percentage of unionisation and collective bargaining coverage and a unique degree of social dialogue and co-operation between social partners. This is exemplified through the Job Security Councils, a structural mechanism developed by trade unions and employers in the 1970s that operate independently from the government and public employment services. The Councils are financed by employer contributions based on collective agreements between social partners in specific industries and sectors, with reference to employment protection legislation.

More than ten Job Security Councils cover almost 80% of the Swedish labour force, including white-collar workers, blue-collar workers and public employees. The Councils provide transitional services to displaced workers based on their individual circumstances and requirements. These transitional services can include training services, business start-up support, advice and labour market information. They also provide tailored advice

and counselling services to both employers and trade union representatives during the earliest stages of restructuring, with the aim of managing voluntary and compulsory redundancies. Crucially, Job Security Councils provide tailored advice to both employers and trade unions at the very early stages of the unemployment process, often even before workers are officially unemployed. As a result, the majority of re-employment offers to displaced workers are made before the end of the formal redundancy transition period. In 2016, the Council responsible for white-collar private sector employees (*Trygghetsrådet*) was successful in finding new employment opportunities for 88% of laid-off workers.

The Job Security Councils in Sweden are remarkable in their capacity to provide rapid response services in the case of mass layoffs of entire workplaces, but also in terms of extending early intervention measures to individual and small-scale layoffs. This helps workers from all backgrounds and competences transition to new work, regardless of the nature of the previous employment. The Job Security Councils further highlight the role of constructive engagement among all concerned parties, including individuals, trade unions and employers, while also accommodating the specific needs of displaced workers.

Source: (OECD, 2018[24]); (Eurofound, 2019[86]).

The impacts of digital transformation on jobs is likely to differ across locations. Important geographical disparities exist for both the likelihood of digitally induced job creation and automation within countries, placing emphasis on ***regional development*** policies. Digital transformation may exacerbate inequalities between regions, as new jobs might appear in places other than where jobs have been lost (Sorbe, Gal and Millot, 2018[62]). For example, evidence from the United States shows that new industries have mainly appeared in urban locations that have a large share of high-skilled workers (Berger and Frey, 2015[87]), and that regions which are most exposed to the adoption of robots have seen negative effects on employment and wages (Acemoglu and Restrepo, 2017[88]). OECD analysis also finds that regions that face a lower likelihood of automation tend to have a larger share of workers with tertiary education, more jobs in services, and are highly urbanised (OECD, 2018[89]).

One approach to enhance labour mobility and help displaced workers transition back into employment is to reduce the costs of relocating, e.g. through subsidies. In addition, well-designed housing policies can play an important role for the geographical mobility of workers by helping people to move into the regions where more and better jobs are available (Andrews, Caldera Sánchez and Johansson, 2011[90]); (OECD, 2015[50]).

Society



Digital transformation affects society in complex and interrelated ways because digital technologies dramatically change the ways in which individuals, firms and governments interact among and with one another. Societal effects of digital transformation are often complex because overall impacts may not be clear-cut and vary across countries. For example, digital technologies provide opportunities to enhance access to information (a free and interconnected Internet), improve health care (e.g. telemedicine), and enrich education (e.g. MOOCs).

On the other hand, challenges arise related to work-life imbalances; the segregation of people into relatively isolated, like-minded groups; negative mental health outcomes such as screen addiction, depression and cyberbullying, including among children; and the emergence of digital divides (e.g. in skills, gender and income groups). To make digital transformation work for inclusive societies and well-being, multiple policy domains need to be considered: social policies (e.g. housing, income and welfare), skills, tax and benefits, environment, health care and digital government.

Digital transformation changes the distribution of benefits, raising the question of where life is getting better, and for whom, making ***social policies*** an important part of the policy toolbox. In particular, social policies can help address a range of digital divides. For instance, geographic divides – such as when knowledge-intensive firms concentrate geographically in those places that are relatively abundant in high-skilled workers – may need to be addressed, including through place-based and social policies (Moretti, 2012[91]); (Berger and Frey, 2015[87]); (OECD, 2018[89]). While highly-skilled workers are often already internationally mobile and able to follow higher returns for wages (OECD, 2008[92]), attention should be paid to policies, like housing, that can facilitate geographic mobility for lower-skilled workers.

Digital divides may also persist along other dimensions. For example, groups such as the elderly and those with lower levels of education and income are less sophisticated users of digital technologies and might thus miss out on related benefits (OECD, 2017[41]). Women also report lower use of some digital technologies, with worldwide over 250 million fewer women than men online. There are also fewer women in science, technology, engineering and math (STEM) professions (OECD, 2018[19]) and fewer female entrepreneurs (OECD/European Union, 2017[93]), and those women that do start businesses in the ICT sector face socio-cultural gender bias when raising capital (Breschi, Lassébie and Menon, 2018[94]). Such gaps, and others for other groups, can be reduced through well-targeted social policies.

Well-being for individuals is often linked to optimal social outcomes from the efficient and effective delivery of public services, including through targeted social policies. Digital tools can help governments make informed social policy choices through the use of longitudinal and multi-domain data about their communities, including with respect to biological, family, social and environmental factors, which can in turn be used to inform policy-making and improve well-being (Box 9).

Box 9. Society Policy Practice: Citizen-based analytics for better social investment in New Zealand

In New Zealand, policy makers developed an Integrated Data infrastructure (IDI) to facilitate targeted and more effective social expenditure. The IDI gathers over 166 billion points of longitudinally-linked and de-identified data about health and safety, justice, benefits and social services, tax and income, education and training, student loans and allowances, travel and migration and family and households from a range of sources, including the Census, government agencies and non-governmental organisations. The unprecedented depth and richness of these data have enabled researchers to better understand the economic and social outcomes of specific groups and households over time, and thus develop more sophisticated methods of targeting public services.

Often interventions made by governments are serial and the benefits disseminate throughout families and communities. Similarly, social interventions are often undertaken by more than one policy community or ministry. Linking data and analysing social outcomes as a result of programme delivery across the eco-system of the public service can better enable whole-of-government co-ordination, and track changes in outcomes on an individual level.

For example, an analysis using linked longitudinal data was conducted to understand the wider benefits and costs of government-funded housing in New Zealand, particularly for those previously incarcerated. The analysis found that the provision of social housing reduced the Department of Corrections' spending per prisoner by 25% by reducing the average length of time that the recipients spent in prison. However, there were also additional downstream effects. It was found that additional social housing also resulted in a further NZD 16 million spent on education for the children of ex-prisoners as they were more likely to spend more time in education, while an additional NZD 31 million was spent on social development and welfare payments.

By better collecting and using information in an integrated way, digital transformation enables a fuller understanding of the costs and benefits of public interventions, including potentially underestimated positive spillovers. This in turn enables policy makers to develop more targeted policies to improve well-being for individuals and their communities.

Source: (Gluckman, 2017[95]).

To ensure that digital transformation benefits all and to avoid that it exacerbates existing divides, it is essential to support ***skills*** development throughout the life cycle, especially through education and training policies. This involves a range of foundational competences, including literacy, numeracy and problem solving skills (see Use), but also social and emotional skills – so-called soft skills – that are increasingly valued by employers (see Jobs) and more generally by society. Approaches to develop such skills include working with students' feelings and relationships, like role-playing, collaborative-

based pedagogies, gaming, case studies, problem solving pedagogies, as well as sports and the arts (Le Donné, Fraser and Bousquet, 2016[96]).

As economies and societies change and adjust, redistribution policies such as ***tax and benefit*** policies are important to ensure that no one is left behind. Redistribution through income support has declined across the OECD alongside a decline in the share of personal income taxes, but this change has been partially offset by higher aggregate spending on policies like healthcare (Causa and Hermansen, 2017[97]). Beyond financial support, it is important that in-kind transfers are used to help those that benefit relatively less from digital transformation. Patterns of redistribution may also need to be reconsidered in light of changes to the organisation and nature of work (Causa, Vindics and Akgun, 2018[98]), which intersects with the challenges for workers in the digital age (see Jobs).

Digital technologies likewise present both opportunities and challenges for tackling some of the great, collective challenges of our time. With respect to the ***environment***, for example, digital technologies can improve environmental performance and support green growth in at least three ways: 1) through decreasing the environmental footprint of the ICT sector, 2) by enabling efficiencies and monitoring, for example, in "smart" infrastructures and cities, and 3) through systemic effects, changing social and cultural behaviour. On the other hand, the widening range and rapid diffusion of digital technologies may increase resource and energy demands in production and use, offsetting some of the environmental gains they can bring and resulting in greater need for recycling and disposal of old equipment, including the growing number of sensors and other technical components embedded in a variety of connected products.

Furthermore, e-commerce, including across borders, can challenge the application of nationally implemented recycling regimes and principles, such as extended producer responsibility (Hilton et al., 2019[99]). And while digital transformation can reduce co-ordination and transaction costs in global value chains (GVCs), it can also affect the distribution of environmental footprints of production and trade across countries (De Backer and Flaig, 2017[100]). The OECD Recommendation on ICTs and the Environment provides guidance on leveraging the potential of digital technologies to improve environmental performance and to mitigate their negative environmental impacts (Box 10).

Box 10. OECD Guidance on Society

OECD Recommendation of the Council on the Protection of Children Online (2012)

The OECD Recommendation of the Council on the Protection of Children Online outlines a series of policy principles for protecting of children online, in recognition of the unique risks associated with increasingly varied use of the Internet by minors. The Recommendation focuses on the challenges faced by governments for policy making in this area with respect to managing policy complexity, adopting an evidence-based policy making approach, and fostering international co-operation to improve the efficiency of national policy frameworks. It notes that all policies made to make the Internet safer for minors should aim to remain flexible, proportional and focus on empowering children and parents to evaluate risks.

OECD Recommendation of the Council on Health Data Governance (2016)

The OECD Recommendation of the Council on Health Data Governance lays out the framework conditions to encourage greater availability and processing of health data within

countries and across borders for health-related public policy objectives, while ensuring that risks to privacy and security are minimised and appropriately managed. The Recommendation is based on 12 high-level principles, ranging from engagement and participation of a wide range of stakeholders, to effective consent and choice mechanisms, to the collection and use of personal health data, to monitoring and evaluation mechanisms. These principles set the conditions to encourage greater cross-country comparison and harmonisation of data governance frameworks so that more countries are able to use health data for research, statistics and healthcare quality improvement.

OECD Recommendation of the Council on Information and Communication Technologies and the Environment (2010)

The OECD Recommendation of the Council on Information and Communication Technologies and the Environment recommends that in establishing or reviewing their policies for communication technologies and the environment, countries take due account of and implement the principles that enhance the contribution of digital technologies (referred to as ICTs in the Recommendation) to improving environmental performance, addressing climate change, e.g. through increasing energy efficiency and managing scarce resources, and tackling other environmental challenges such as the protection of biodiversity. Such contributions can come from direct effects, such as lower energy consumption, indirect effects through the use of digital technologies across sectors, as well as from underpinning systemic behavioural changes that contribute to better environmental performance.

OECD Recommendation of the Council on Gender Equality in Public Life (2015)

The OECD Recommendation of the Council on Gender Equality in Public Life promotes a government-wide strategy for gender equality reform, sound mechanisms to ensure accountability and sustainability of gender initiatives, and tools and evidence to inform policy decisions. It also outlines policy options to boost equal access to public life, including politics, judiciaries, and public administrations for women and men from diverse backgrounds.

OECD Recommendation of the Council on Artificial Intelligence (2019)

The OECD Recommendation of the Council on Artificial Intelligence is the first intergovernmental standard agreed by governments for the responsible stewardship of trustworthy AI. The Recommendation identifies five values-based principles: 1) AI should drive inclusive growth, sustainable development and well-being, 2) AI systems should respect the rule of law, human rights, democratic values and diversity, and they should include appropriate safeguards, 3) there should be transparency and responsible disclosure around AI systems, 4) AI systems must function in a robust, secure and safe way, and 5) organisations and individuals developing, deploying or operating AI systems should be held accountable for their proper functioning. In addition to and consistent with these value-based principles, the Recommendation provides five recommendations to policy-makers pertaining to national policies and international co-operation for trustworthy AI.

Source: (OECD, 2012[101]); (OECD, 2016[102]); (OECD, 2010[103]); (OECD, 2015[104]); (OECD, 2019[105]).

Health care is another great challenge for which digital technologies present both opportunities and challenges. For example, health-care providers can improve care and potentially reduce costs by digitising health records, using new surgery machinery, expanding tele-medicine, and implementing mobile health technologies (see Innovation). At the same time, big data and data analytics drive personalised care, while increasingly mobile digital technologies help improve knowledge about health status, disease progress and the level of motor and cognitive functions. However, data-driven health services also raise new challenges related to personal data protection and privacy, security, control and ownership, transparency and accountability, and quality and safety, many of which can be addressed through good health data governance (Box 10).

Governments increasingly implement ***digital government*** strategies to enhance citizen involvement (OECD, 2017[106]). The shift from e-government[10] towards digital government[11] reflects a move away from top-down assumptions to involving a range of stakeholders to improve the delivery of policies and services and letting user needs drive decisions. In particular, greater openness and public engagement brings citizens' needs into the design, development, delivery and monitoring of public policies and services (citizen-driven approaches). For example, digital tools enable more comprehensive and efficient public consultations; regulators may liaise with consumer organisations, academics and the technical and business communities to monitor key trends and technological developments; and information that is increasingly gathered by private organisations can more easily be used by all stakeholders to achieve public policy goals.

Digital government can empower users to access digital public services at their convenience and in new ways, including through enhanced interaction with public administrations within and across tiers of government. Where the provision of services is fragmented across disparate public agencies, the "once only" principle[12] can reduce the burden for citizens and businesses of having to provide the same information multiple times, and digital one-stop-shops can ease access to information and assistance, such as for job seekers. More detailed information that governments can gather through interacting with citizens online can also allow better personalisation of public services and better targeting public policies.

There are a range of social issues that have emerged or become heightened as digital transformation progresses. For one, the ubiquity of digital technologies means that people can engage in more flexible working arrangements, such as teleworking, which can help families deal with schedules that do not map well to a regular working day. However, research suggests that telework opportunities are largely available to the highly skilled (Billari, Giuntella and Stella, 2017[107]), and the fact that it is possible for workers to connect to work from home during all hours can lead to high levels of stress (Belkin, Becker and Conroy, 2017[108]). Moreover, challenges related to work-life balance in digital work environments also need to be addressed.

Digital transformation can also raise questions about ethics and morality. For example, AI and machine learning raise new questions about transparency (possible biases that can potentially lead to discriminatory impacts), responsibility and accountability, in particular in the context of autonomous decision making. Multi-stakeholder co-ordination enables all stakeholders, including the techno-scientific communities, governments, individuals, trade unions, firms and civil society groups, to take part in developing human-centred principles for AI (OECD, 2019[109]).

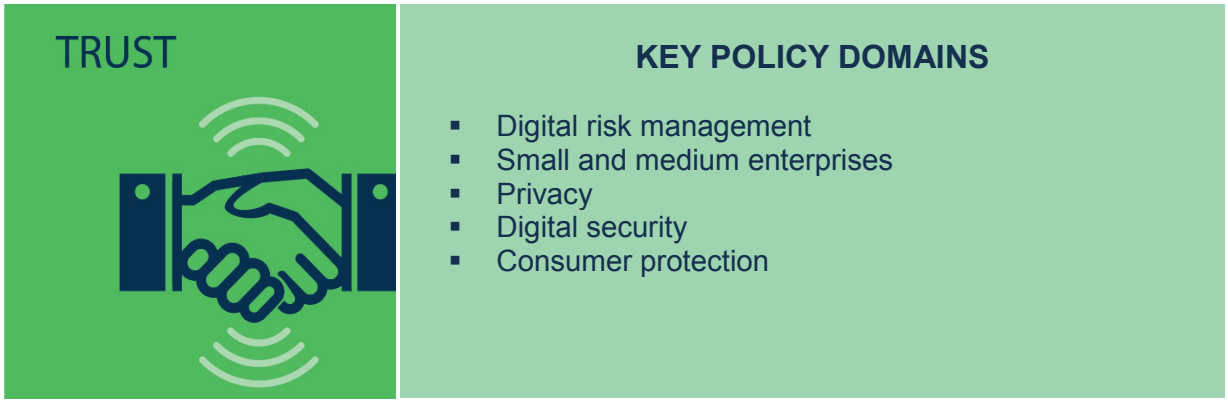
Digital technologies can also extend the public sphere into the private sphere and vice versa, shrinking the sense of private space, particularly as social networking becomes more

prevalent. Moreover, many offline interactions have an online component. There is competing evidence about whether online interactions supplement, complement or displace offline social contacts (OECD, 2019[110]). On one hand, an increase in the use of online social interactions can increase interactions between users, with potential positive impacts on identity, belonging and feelings of loneliness. On the other hand, digital transformation also enables the easier and faster dissemination of potentially negative social interactions, including cyberbullying, hate speech and discrimination against specific groups.

As digital technologies enable connections irrespective of distance, geographically dispersed communities are also created and nurtured. Such groups can form along a range of different dimensions, but one that has gained much attention is the way in which people consume news and interact with the political process. As digital technologies enable faster dissemination of information and new forms of organisation and identification, individuals can become more empowered to take part in social or political discussions (OECD, 2019[110]).

Disinformation has gained attention recently, as digital technologies facilitate its faster and wider dissemination. Disinformation is defined as all forms of false, inaccurate, or misleading information designed, presented and promoted to intentionally cause public harm or for profit (European Commission, 2018[111]). While disinformation is neither new nor necessarily illegal, some have raised concerns that it negatively affects individuals and society more broadly (European Commission, 2018[111]); (UK House of Commons, 2018[112]); (Ministry of Foreign Affairs of Denmark, 2018[113]); (Swedish Civil Contingencies Agency, 2018[114]). Although the extent of disinformation is not yet clear, it has risen high on the policy agenda in many countries. Addressing the challenges posed by disinformation in the digital age and preserving the opportunities in the information environment will require broad, whole-of-society efforts involving individuals, firms and governments.

Trust



To fully embrace and benefit from digital transformation, individuals, firms and governments need to be confident that engaging in the digital environment to conduct their social and economic activities will bring more benefits than downsides. Such downsides can arise from various sources of uncertainties affecting digital technologies, data and cross-border flows. Many relate to potential digital security incidents (e.g. breaches of availability, integrity or confidentiality of data, systems or networks). Other downsides relate to information asymmetries, power imbalances or jurisdictional challenges exacerbated by the digital environment. These may translate into breaches of laws and regulations such as privacy, consumer protection or product safety, intended to reduce these imbalances and challenges.

The consequences of undesirable events, for example the theft of business assets or of an individual's identity, or the misuse of personal data, can affect all actors' reputation, finances, freedom, autonomy, health, well-being, safety, competitiveness or efficiency, and ultimately limit their willingness to fully engage in the digital environment. They can also compromise the functioning of our society as digital security incidents can affect critical activities, such as in energy, finance, and transport. Multiple policy domains need to be considered to ensure trust, including: digital security[13], privacy and consumer protection, with special attention to SMEs.

Trust is essential in situations where uncertainty and interdependence exist (Mayer, Davis and Schoorman, 1995[115]), and the digital environment encapsulates these factors. While there is no universally agreed definition of trust, it can be understood as the positive outcome of the capacity to deal with uncertainties. Therefore, trust depends upon the context and varies with what is at stake, including opportunities and challenges.

From an individual's point of view, trust in the digital age is about the willingness to risk time, money, and disclosure of personal data to engage in commercial and social activities, and to become vulnerable if a purchase goes wrong or if their data is stolen or if it is used to monitor their behaviour, to discriminate against them or to violate their privacy. From an organisations' point of view, trust is also about accepting a certain level of risk resulting from possible digital security, privacy, consumer protection incidents to benefit from digital transformation. Trust is therefore a key condition to fully realise the potential growth and well-being in the digital age.

In practice, the most effective way to deal with uncertainties is to manage digital risks. Because uncertainties cannot be eliminated, risks cannot be entirely avoided without forgoing the benefits of the activity at stake. The result is that some degree of risk must be

accepted to harness the benefits of an activity, or in other words, risks need to be reduced to an acceptable level in light of the objectives and benefits to be achieved. This requires learning to assess risks and to manage them, which includes deciding whether to accept, reduce, transfer, or avoid risk, the latter by not engaging in digital activities.

Digital risk management applies to individuals as well as to organisations, from small businesses to large firms to public entities. All actors share some responsibility to manage digital risks to their activities according to their roles, ability to act, and to the context, and need to be equipped with the right skills to do so. As risk is a cross-boundary, cross-sector, and multi-stakeholder issue, digital risk management provides a common reference framework for different policy communities to discuss trust policies in an integrated manner and for the different actors to consider and address the risks in a more holistic way, building on the fundamental components of a risk management cycle. These components include:

- Establishing the objectives and the context of an activity and determining the acceptable level of risk;
- Assessing risk by identifying risk factors, and evaluating the likelihood and severity of risk occurrence;
- Treating risk, including through accepting some, reducing it to the acceptable level through appropriate measures, sharing or transferring some, and/or avoiding some altogether; and
- Monitoring and reviewing on an ongoing basis this risk management cycle to adapt it to a constantly changing environment.

Policies that foster digital risk management are crucial to foster trust and enable individuals and organisations to maximise their economic and social objectives. Risk management practices are likely to differ according to whether the objective is digital security, privacy, consumer protection or product safety, but policies need to account for interrelations between different categories of risks. Measures that may be appropriate for an individual may not be the same for a large private corporation, even though both actors may pursue the same objective. In addition, transparency is an important condition for actors to trust each other's ability to appropriately manage risk.

SMEs, and start-ups in particular, are critical to economic growth in contributing to competition, innovation and job creation. However, they also face distinct challenges in managing digital risk. For example, a digital security incident that results in a loss of consumer trust, damage to reputation or a drop in revenue, may be more damaging for SMEs than for larger companies because they are more likely to find it difficult to weather a temporary loss of customers or revenue.

Typically, SMEs also lack the awareness, resources or expertise to effectively assess and manage risk. On the positive side, awareness of digital risk and robust risk management practices may bring them competitive advantage when seeking partnership opportunities with larger organisations. To help SMEs realise these opportunities, and to avoid that unmanaged risk puts an SME and/or its business partner(s) in danger, it is essential to increase awareness and promote good practices (Box 11).

Box 11. Trust Policy Practice: Digital risk management in SMEs

Digital risk management in SMEs is increasingly important not only for SMEs themselves but also for the resilience of GVCs in which they increasingly take part. By potentially being the weakest link in interdependent networks and value chains, SMEs can compromise the digital security of others in the ecosystem. For example, in 2015 the personal information of 70 million customers of the American multinational retail firm Target was compromised after criminals gained access to the firm's information system by penetrating a small heating and air conditioning contractor that was working with Target (McGrath, 2014[116]).

Increasing SMEs' awareness of digital risk and elevating their capacity to manage it is therefore crucial. Given that SMEs may lack expertise and face resource constraints, larger organisations, industry associations, the technical community and governments can play an important role in this area and share their knowledge, skills and expertise about best practices in managing digital risk.

To improve the conditions for SMEs to adopt digital risk management frameworks, SME-specific risk management guidance tools and incentives can help. For example, the German Federal Ministry for Economic Affairs and Energy introduced the initiative IT Security in Industry (*IT Sicherheit in der Wirtschaft*) with the aim of improving the digital security of SMEs (Bundesministerium für Wirtschaft und Energie, 2018[117]). It includes, for example, a free digital security check that considers the implications of new directives like the EU General Data Protection Regulation. The programme also offers malware and virus checks and disseminates information about ICT security, data protection and ongoing privacy and risk management. Other examples include the United Kingdom Cyber Essentials scheme (UK National Cyber Security Centre, 2018[118]) and the French Guidelines for a Healthy Information System (Agence National de la Sécurité des Systèmes d'Information (ANSSI), 2013[119]).

Source: (McGrath, 2014[116]) ; (Bundesministerium für Wirtschaft und Energie, 2018[117]); (UK National Cyber Security Centre, 2018[118]); (Agence National de la Sécurité des Systèmes d'Information (ANSSI), 2013[119]).

As digital transformation progresses, ***privacy***, and the protection of personal data in particular, is emerging ever more as a critical factor influencing trust. Personal data have come to play an increasingly important role in our economies, societies and everyday lives, and new technologies and responsible data uses are yielding great societal and economic benefits. At the same time, the abundance of personal data gathered, processed and exchanged has elevated the risks to individuals' privacy.

Personal data is being increasingly used in ways unanticipated at the time of collection, including in ways that allow sensitive information to come to light or to link supposedly anonymous data to specific individuals. With the growth in the use and value of data, personal data breaches have become more common (OECD, 2017[13]). These risks implicate not only the individuals concerned, but the core values and principles which privacy protection seeks to promote, such as individual autonomy, equality and free speech, which may have a broader impact on society. Privacy and personal data risks therefore need to be better managed to provide effective safeguards.

Privacy is not only a recognised fundamental value that merits protection, but a condition for the free flow of personal data across organisations and borders, and with it a condition

for data-driven innovation, economic growth and social prosperity (OECD, 2016[16]). Individuals, at home and on the job, share more personal data today than ever before – willingly, on social networks and elsewhere, but also unknowingly, through web browsing or via their smartphones. At the same time, individuals seek more assurance about and control of the way their data is handled: they want to know if and what personal data about them are collected and stored, how they are used, and whether they can delete or correct data, or control any secondary uses.

Technological advances can help increase trust through "privacy by design" whereby privacy implications are considered at the initial design phase of a product or service. This may enable privacy protection to be embedded or coded in technology and minimise personal data collection from the start. For example, encryption can play an important role for privacy as mobile devices and the IoT expand (OECD, 2017[13]). Another approach to address privacy concerns is the "re-decentralisation of the web", which implies distributing personal data storage among Internet users themselves instead of centralising them in a small number of companies.

While technology can help, it cannot replace a strategic approach to protect privacy and personal data. One example is a national data strategy, supported at the highest level of government, which incorporates a whole-of-society perspective and strikes a balance between individual and collective interests. Such a strategy would provide clear direction on how to reap the social and economic benefits of enhancing access to and sharing of data while addressing individuals' and organisations' concerns about the protection of privacy and personal data, and IPRs. It would also facilitate interoperability of national frameworks and the free flow of data.

While countries apply different privacy frameworks, they are largely pursuing the same outcomes, and frequently use similar approaches, as demonstrated by agreement on high-level guiding principles and good practices or legislation. The OECD Privacy Guidelines are a pioneer in this field (see Box 12), and the European General Data Protection Regulation is a most recent example. Enforcement initiatives such as the Global Privacy Enforcement Network and the opinion of the European Data Protection Supervisor on online manipulation and personal data are other noteworthy examples.

Box 12. OECD Guidance on Trust

OECD Recommendation of the Council Concerning Guidelines on the Protection of Privacy and Transborder Flows of Personal Data (2013)

The OECD Privacy Guidelines – the first internationally agreed upon set of privacy principles, last revised in 2013 – provides a set of eight principles that apply to both the public and private sectors: 1) the collection limitation principle, 2) the data quality principle, 3) the purpose specification principle, 4) the use limitation principle, 5) the security safeguards principle, 6) the openness principle, 7) the individual participation principle, and 8) the accountability principle. Two themes run through the Privacy Guidelines: a focus on the practical implementation of privacy protection through an approach grounded in risk management, and the need to address the global dimension of privacy through improved interoperability.

OECD Recommendation of the Council on Digital Security Risk Management for Economic and Social Prosperity (2015)

The OECD Recommendation of the Council on Digital Security Risk Management for Economic and Social Prosperity provides guidance for all stakeholders on the economic and social dimensions of digital security risk. In an economic context in which the digital environment has become essential to growth, well-being and inclusiveness, digital security risk should be considered with respect to the broader economic and social perspective. The Recommendation introduces the notion that digital security risk should be treated like an economic rather than a technical issue, and should be part of an organisation's overall risk management and decision-making. The Recommendation also underscores that all stakeholders have a responsibility for understanding and managing digital security.

OECD Recommendation of the Council on Consumer Protection in E-Commerce (2016)

The OECD Recommendation of the Council on Consumer Protection in E-Commerce covers business-to-consumer e-commerce. It underscores that consumers buying online are entitled to the same level of protection as with conventional transactions. More specifically, the Recommendation addresses challenges relating to information disclosure, misleading and unfair commercial practices, confirmation and payment, fraud and identity theft, product safety issues, and dispute resolution and redress. Revisions in 2016 expanded the scope to include business activities that enable peer-to-peer transactions and to cover non-monetary transactions. They also adapted its provisions to address recent challenges related to digital content, consumer reviews and ratings, new payment mechanisms, and the use of mobile devices to conduct transactions.

Source: (OECD, 2013[120]); (OECD, 2015[121]); (OECD, 2016[122]).

Interoperability of privacy and data protection frameworks need to be fostered internationally. One example of regional convergence and harmonisation of privacy frameworks is Convention 108 of the Council of Europe, which binds 47 Council of Europe member states and is open to non-members. Another one is the Asia-Pacific Economic Cooperation organisation's voluntary but enforceable system of Cross-Border Privacy Rules, a non-binding arrangement that encourages convergence of privacy laws and facilitates privacy-respecting data flows. Other approaches include the recognition of "equivalency" or "adequacy" of privacy measures, cross-border co-operation between privacy enforcement authorities, and regional trade agreements (OECD, 2019[1]).

Digital security is a multifaceted policy domain that includes issues related to economic and social prosperity, technology, criminal law enforcement, as well as national and international security. From the economic and social perspective, digital security risk has traditionally been approached as a technical problem calling for technical solutions. However, the changing nature and scale of digital security risk is driving governments to re-evaluate their strategies to call for a cultural change in this area.

Given that it is impossible to create an entirely safe and secure digital environment, businesses, other organisations and individuals always take some security risk when going digital. They should thus be encouraged to understand how to manage digital risk in a manner that does not impede the economic and social opportunities of using digital technologies. This can include, for example, the implementation of security standards (e.g. ISO 27000 series) to increase resilience and maintain business continuity by mitigating the potential consequences of security incidents. Because all stakeholders are interdependent in the digital environment, including as across borders, it is important to foster partnerships

among them, including SMEs, to help reduce risk and promote good risk management practices, in particular through information sharing about threats, vulnerabilities and incidents.

Public policies to foster digital security can play an important role in creating the conditions for organisations to adopt digital security risk management frameworks, for firms to develop more secure technologies, and for individuals to better understand digital risks and use digital devices more responsibly. Public policies can also address the growing digital security skills shortage among both technical security experts and business managers, encourage digital security innovation, as well as the development of a vibrant digital security industry. Cyber insurance can be an important element of managing digital security risk by enabling the transfer of some risk and by creating incentives for better risk management practices.

Digital security and resilience of critical activities, essential for the functioning of our economies and societies, are a particularly important aspect of digital security policy at the crossroads of economic prosperity and national security. Digital transformation significantly increases the interdependencies of critical activities, the complexity of systems, and the risk of systemic failures cascading across sectors and borders. Governments must adopt policies that encourage critical infrastructure and services operators to strengthen their digital security risk management. In doing so, they need to enable them to make the most of digital transformation, including through the adoption of technologies such as the IoT, AI, big data analytics and blockchain, and to take into account existing sector-specific market, regulatory and cultural specificities. While critical activities often rely on large and often private sector operators, digital transformation also empowers SMEs to take part in essential services' value chains (OECD, 2019[123]).

Protecting consumers online is another crucial aspect of ensuring trust, whether in e-commerce or in the use of new technologies like the IoT. It opens up possibilities for new customers and markets, bringing broader economic benefits as well. Establishing a flourishing e-commerce marketplace requires more than broadband infrastructure, hosting and payment facilities, and specialised software. It requires a willingness on the part of consumers to overcome doubts about transacting at a distance where goods cannot be examined in advance, fears about the risks of entering payment details online, and concerns about whether there can be remedies or redress or if something goes wrong.

It is important to effectively protect consumers engaged in e-commerce and other online activities for the digital economy to flourish. Transactions involving digital content and blurred boundaries between consumers and businesses can also complicate traditional ideas of ownership, liability, rights and obligations. Key challenges relate to information disclosure, misleading and unfair commercial practices, confirmation and payment, fraud and identity theft, product safety, and dispute resolution and redress.

For example, consumers increasingly acquire "free" goods and services in exchange for their personal data through non-monetary transactions, which can challenge traditional mechanisms for consumer dispute resolution (OECD, 2016[122]). Similarly, novel forms of asset and content usage, including through rental, asset sharing, and subscription services, pose challenges for consumers' understanding of their rights and obligations. Limitations on functionality and interoperability are likewise often not made clear.

In financial markets, individuals (notably those with low levels of digital literacy) need new skills and knowledge to be able to use new digital products and services effectively, and understand the potential ramifications of sharing data. Further, as consumers

increasingly rely on automated processes and non-human support (e.g. robo-advice, chatbots), governance and controls must be put in place to ensure financial consumer protection. Increasingly, frictionless transactions can raise questions about consumers' understanding of the terms and the nature of such transactions, an issue that becomes even more important as more digital activities are undertaken on mobile phones.

Overall, it is crucial to establish risk management as a common reference framework to develop coherent policies to enhance trust, involving the policy communities around digital security, privacy, consumer protection and product safety. In particular, policy makers should consider interrelations between digital risks in each of the areas. For example, a digital security incident where an identity is stolen to commit fraud can violate privacy and consumer rights. Such interrelations underscore the importance of co-ordinating policies among the three areas as a basis of a more comprehensive approach to trust in the digital age, taking into account the guidance by the OECD (Box 12).

Market openness



Digital technologies are transforming the environment in which firms compete, trade and invest. Market openness enables digitalisation to flourish by creating a business-friendly environment that allows foreign and domestic firms to compete on an equal footing and without excessive restrictions or burdensome regulations. Market openness policy domains include trade, investment, financial markets, competition and taxation. Digital transformation also affects market openness policy domains, raising opportunities and posing challenges. Governments could benefit from periodically reviewing market openness policies and, where appropriate, update them to ensure that they are well suited to making digital transformation work for growth.

Digital technologies and data profoundly affect international ***trade*** by reducing trade costs; facilitating the co-ordination of GVCs; diffusing ideas and technologies across borders; and connecting greater numbers of businesses and consumers globally, all of which push out the trade frontier. Digital technologies and an open, non-fragmented Internet ecosystem are potentially creating new opportunities for trade, enabling new value chains with new players and new business models, and spurring innovation.

Digital transformation is not only changing how we trade but also what we trade: a larger number of smaller and low-value packages of physical goods, as well as digital services, are now crossing borders; goods are increasingly bundled with services; and new and previously non-tradeable services are being traded across borders. The rise of services in international cross-border trade is closely linked to rapid technological developments. Services that traditionally required close proximity to customers now can be traded at a distance, allowing firms to reach global markets at lower costs.

Yet services regulations remain fragmented by borders, and regulatory frictions create trade costs for services providers, particularly for SMEs. As a result, the benefits of digital technologies may be diminished by existing and emerging trade barriers that hold back innovation and create obstacles to the movement of services that enable digital delivery across borders. At the same time, growing digital connectivity drives falling communication and co-ordination costs, enabling more physical, or traditional, trade to take place, and increasing access to foreign markets for firms, particularly for SMEs.

Innovative business models that use digital technologies and services like digital matching services, logistical support and secure online payment systems are providing solutions that enable firms to sell their products online and in new markets, reducing some of the complexity of trade in the digital age (OECD, 2019[124]). For instance, online platforms have lowered barriers to entry for firms to trade, including by allowing smaller firms to pay

for and use the platform's logistics and customer service infrastructure to sell in global markets. Other digital-intensive firms combine their online services with local or offline activities to sell new types of products globally. This can also affect outsourcing and offshoring dynamics.

Cross-border data flows support trade transactions. They underpin trade by enabling control and co-ordination along GVCs, or by supporting implementation of trade facilitation measures. Reaping the benefits of digital trade requires multi-stakeholder dialogue on regulatory approaches that ensure the interoperability of differing regulatory regimes, particularly for transversal issues such as cross-border data flows. On the one hand, emerging measures affecting cross-border data flows raise concerns for business activity and the ability to benefit from digital trade. On the other hand, important public policy objectives, such as the protection of privacy, security and IPRs, must be taken into account. The challenge is to address public policy objectives in a manner that is not arbitrary or discriminatory so as to preserve the significant economic and trade benefits flowing from data-enabled trade. To support this dialogue, one important step will be to better understand the nature and composition of heterogeneous data flows and clarify the scope of the public policy objectives being pursued.

While market openness underpins trade in the digital age, new issues emerge in tandem, such as digital connectivity and interoperability, including internationally interoperable e-payment systems. Additionally, the greater bundling of goods and services enabled by digital transformation challenges traditional market openness distinctions between goods and services. Not only do these now have to be considered jointly, but a greater focus on openness to information transfer and connectivity is also needed. Market openness in the 21st century therefore needs to be approached holistically.

Box 13. Market Openness Policy Practice: Customs unions

Promoting open markets enables digital transformation to thrive, including by facilitating international technology transfer. One way that countries promote market openness is through the formation of custom unions. In some cases, customs unions specifically seek to make the most of the opportunities of digital technologies and data through targeted initiatives.

For example, the ASEAN Economic Blueprint 2025 aims to achieve economic integration within the Association of the Southeast Asian Nations (ASEAN) but also within the broader global economy. One of its main objectives is to facilitate the seamless movement of goods, services, investments, capital, and skilled labour within ASEAN to enhance the region's trade and production networks, as well as to establish a more unified market for its firms and consumers. This will be achieved by continuing its efforts to reduce or eliminate border and behind-the-border regulatory barriers that impede trade, and in doing so enhance the region's participation in GVCs. The ASEAN Economic Blueprint 2025 also aims to further enhance ASEAN's attractiveness as an investment destination globally through the establishment of an open, transparent and predictable investment regime (ASEAN, 2015[125]).

From the digital perspective, the ASEAN Economic Blueprint 2025 focuses on the use of digital technologies to boost trade and investment. In particular, the ASEAN Single Window (ASW) aims to facilitate trade and the free flow of goods between ASEAN members by harmonising standards and integrating customs procedures (ASEAN,

2015[125]). The ASW is a digital platform that connects and integrates the national single windows of the ASEAN members to expedite the electronic exchange of trade and customs-related documents (e.g. clearances, permits and other documentation) within the ASEAN region (ASEAN, 2019[126]). It has been estimated that with the new mechanisms of the ASW in place, the ASEAN digital economy has the potential to grow to USD 200 billion by 2025, with e-commerce accounting for USD 88 billion (Min, 2018[127]).

The European Union (EU) is another example of a customs union in which one of the aims is to promote market openness. The EU Customs Union applies a uniform system for handling the import, export and transit of goods and implements a common set of rules called the Union Customs Code (UCC) (European Commission, 2016[128]). It is a single trading area where all goods circulate freely, whether made in the EU or imported from outside. For example, a Finnish mobile phone can be dispatched to Hungary without any duty or customs controls. Hence, this comprehensive system of regulations for the region's imports and exports upholds a tariff-free movement, which, ultimately, ensures market openness and increases economic efficiency and integration.

The EU Digital Single Market is one of the EU's 10 political priorities. It aims to extend the concept of free flow of goods, people, services, capital and data to the digital realm. The Digital Single Market also seeks to remove or reduce the barriers that EU citizens and businesses face when using online tools and services across the EU. Its strategy has resulted in legislative proposals in a number of priority areas, including e-commerce, copyright, audio-visual and media services, telecommunication, ePrivacy, harmonisation of digital rights, affordable parcel delivery and harmonised VAT rules (European Commission, 2018[129]). The Digital Single Market could contribute EUR 415 billion to the European economy by boosting jobs, growth, competition, investment and innovation. It can expand markets, offering better and more cost-effective services, transform public services and create new jobs.

Source: (ASEAN, 2015[125]); (ASEAN, 2019[126]); (Min, 2018[127]); (European Commission, 2016[128]); (European Commission, 2018[129]).

Investment regimes that mobilise private investment, including in communications infrastructures, technologies, and KBC (e.g. business models, software and data), coupled with open financial markets, attract foreign direct investment (FDI) and underpin digital transformation as a driver of growth. They also help channel resources to more productive uses and, through competitive pressure and the discipline imposed by shareholders and creditors, ensure that all firms strive to improve their efficiency and allow inefficient ones to exit (OECD, 2015[130]). Reducing barriers to investment is thus important to supporting the broader digital transformation.

In addition, multinational enterprises – which by definition operate across borders – can make extensive use of digital technologies and data to organise their business operations and improve processes and procedures (see Use). Use of such technologies also promotes market-based international technology transfer, although knowledge-related spillovers from FDI vary across sectors, with services sectors enjoying the strongest productivity-enhancing effects of FDI (Lesher and Miroudot, 2008[131]).

Intensive use of digital technologies and data may also affect a firm's decision of whether to export or establish a local presence insofar that exporting may become more attractive if products are relatively easily delivered digitally (UNCTAD, 2017[132]). Moreover, as digital technologies support the spread of GVCs (De Backer and Flaig, 2017[100]), the

infrastructures and services needed to support GVCs may become a new variable in a firm's decision of whether and where to invest (Gestrin and Staudt, 2018[133]).

Investment regimes also need to facilitate investment in KBC – such as business models, software, data, intellectual property, economic competences (e.g. firm-specific skills such as management, brand equity, and organisational processes and structures), and skills. Such investment is now larger than investment in machinery and equipment in many countries (OECD, 2017[41]). Business investment in KBC not only helps boost both growth and productivity (OECD, 2013[134]), but it also supports the broader digital transformation by promoting innovation.

Efficient, stable and open ***financial markets***, based on transparency, confidence, and integrity, help to allocate financial resources to firms investing in digital transformation. Open financial markets also ensure that domestic financial services firms remain competitive in the face of foreign competition. Increased competition should make domestic firms more efficient and transparent. Financial flows can lower the cost of capital for firms in countries in which capital is scarce, which in turn can raise investment in digital transformation.

Regulatory frameworks that are sector-based (e.g. bank-focused) can present barriers for more focused services (e.g. payments) to enter the market. Regulators and supervisory authorities need to build capacity to align with the objective of promoting safe and beneficial digitalisation of financial services. In this respect, inter-sectoral and international regulatory co-operation is needed for consistent regulation and information sharing.

Digital technologies also underpin new forms of external funding with the most prominent being crowdfunding, by which external finance is raised through online platforms from a larger audience than only specialised investors. Although it still represents a minor share of all business financing (and serves to finance specific projects rather than enterprises as a whole), crowdfunding may play a growing role, including to finance innovative ventures, as the online interaction with large numbers of customers may help entrepreneurs to validate untested products. In addition, venture capitalist investors, business angels and institutional investors are increasingly finding investment opportunities through crowdfunding platforms, usually through the largest and more developed platforms (OECD, 2017[135]).

Strengthening ***competition*** in the digital age, including by opening access to markets, benefits consumers through lower prices and a greater variety of goods and services, and supports trade and investment. Competitive markets also underpin digital transformation by spurring innovation, new business models, business dynamism, and productivity, driving structural change across the economy.

Digital transformation promotes greater competition in a large variety of product and service markets, both domestically and internationally. In the digital age, geographic market boundaries matter less because the Internet has facilitated the entry and growth of online suppliers and retailers (e.g. Amazon, Rakuten, Alibaba) that do not necessarily need to have a physical presence in all markets in which they sell, which has in turn has helped increase competition and expand GVCs. In turn, digitally-enabled business models have increased competitive pressure on offline incumbents.

Digital technologies can enable new types of goods and services that compete with existing ones (e.g. services that stream television content over the Internet versus cable and satellite TV providers, online publications versus traditional print media, etc.). In some cases, these new goods and services have greatly reduced prices (e.g. financial and brokerage services)

and improved services (e.g. movie rentals). Occasionally, digital technologies and data have helped to make possible new goods and services that disrupt well-established markets (e.g. film cameras replaced by digital cameras, digital cameras supplanted by smartphones, compact discs superseded by digital downloads and streaming).

However, as digital technologies and data lead to greater competition in many markets, they have also demonstrated a potential to tilt others towards greater concentration, market power and even dominance. For instance, in online platform markets, network effects and the possibility to achieve "scale without mass" can drive winner-take-all or winner-take-most outcomes. While network effects – the phenomenon that some products, such as the telephone, become more useful as the number of users increases – are more widely understood, scale without mass refers to a feature of many digital markets that allows companies to add new users at virtually no cost and without investing much into fixed assets.

The impact of digital technologies and data are not always evenly spread across firms and sectors. For example, mark-ups – the wedge between the price a firm charges for its output on the market and the cost the firm incurs to produce one extra unit of output – have been increasing on average across firms and countries, especially for firms at the top of the mark-up distribution and those in digital-intensive sectors (Calligaris, Criscuolo and Marcolin, 2018[136]). Mergers and acquisitions are growing too, with a strong increase in cross-border mergers and acquisitions of firms in digital-intensive sectors (Bajar et al., forthcoming[47]). These developments may not necessarily be a source of concern, they should be further examined and considered by policy makers.

As digital transformation continues to affect competition, it may lead to some new challenges for competition policy frameworks that were designed with traditional products in mind. One such challenge is that digital transformation may introduce new dimensions of competition in markets, as well as new ways to achieve anticompetitive outcomes, such as the use of algorithms to collude. In addition, a range of issues will require competition authorities to enhance their advocacy efforts and deepen their co-operation with consumer protection, data protection and other regulators. These include the use of consumer data as a competitive asset when providing products at a price of zero, or when developing personalised prices. The OECD Competition Assessment Toolkit helps governments to eliminate barriers to competition by providing a method for identifying unnecessary restraints on market activities and developing alternative, less restrictive measures (Box 14).

Co-operation may be needed across borders to ensure that common standards are applied and that information is available to regulators. Bilateral and regional enforcement may also be useful, for example joint decision-making between jurisdictions, although it is important that clear rules exist to indicate how to address enforcement actions if there are bodies with overlapping responsibilities.

Box 14. OECD Guidance on Market Openness

OECD Market Openness Principles (2011)

Market openness is characterised by a regulatory environment where foreign suppliers of goods and services have the ability to "compete in a national market without encountering discriminatory, excessively burdensome or restrictive conditions". This entails not just the elimination of barriers to trade and investment but also the adoption of appropriate

international approaches to trade policy making. The OECD has developed six market openness principles: 1) transparency, 2) non-discrimination, 3) avoidance of trade-restrictive effects, 4) harmonisation of international measures, 5) mutual recognition, and 6) competition. These principles can help better understand which measures might be relevant for openness in digital trade, and how these measures could lead to more favourable regulatory environments for digital trade.

OECD Competition Assessment Toolkit (2015)

The OECD's Competition Assessment Toolkit, consisting of three parts, was revised and extended in 2015. Revisions include Volume 1, which sets out the toolkit principles, and Volume 2, which provides a Competition Checklist and examples of government processes. Volume 2 presents detailed technical guidance on key issues when performing a competition assessment. Volume 3 was issued to provide an operational manual and a step-by-step process for performing competition assessments. The toolkit can be used in three main ways: 1) in the development and review of policies (e.g. the competition authority evaluating competitive impacts of regulations or ministries developing laws), 2) in an overall evaluation of existing laws and regulation, and 3), in the evaluation of draft new laws and regulations (for example, through regulatory impact assessments).

OECD Guidelines for Multinational Enterprises (2011)

The OECD Guidelines for Multinational Enterprises (MNEs) have been a leading tool to promote responsible business conduct since 1976. At the heart of the Guidelines are a set of 15 recommendations from governments to multinational enterprises operating in or from adhering countries. The guidelines provide voluntary principles and standards for responsible business conduct in areas such as employment and industrial relations, human rights, environment, information disclosure, combating bribery, consumer and worker interests, science and technology, competition and taxation. The guidelines aim to ensure that the operations of enterprises are in line with government policies, to strengthen mutual confidence between enterprises and societies, and help improve the foreign investment climate and sustainable development by multinational enterprises. Adhering governments are required to set up a National Contact Point whose main role is to further the effectiveness of the guidelines by undertaking promotional activities, handling enquiries, and contributing to the resolution of issues that may arise from the alleged non-observance of the guidelines in specific instances.

OECD Code of Liberalisation of Capital Movements (2019)

The Code provides a framework for countries to progressively remove unnecessary barriers to the movement of capital, while providing flexibility for countries at different levels of development and in times of economic distress and financial disturbance. It is binding for all OECD countries. Since 2012, the Code has been open to partner economies. The Code is based on a range of premises, including: 1) an open multilateral regime for international capital flows, 2) the entitlement of an adhering country to benefit from the liberalisation of other adhering countries regardless of its own degree of openness, and 3) the reintroduction of capital flow restrictions that can be justified in specific circumstances.

OECD Recommendation of the Council on Principles for Internet Policy Making (2011)

The OECD Recommendation of the Council on Principles for Internet Policy Making includes 14 high-level principles that are designed to help preserve the fundamental

openness of the Internet and the free flow of information, while ensuring that privacy, children and intellectual property are adequately protected. Addressing security challenges and finding ways to enhance trust in the Internet are also key objectives. The principles are not an attempt to harmonise global law, but rather to provide a common framework for companies and governments as they consider new initiatives with respect to access to information, its distribution, portability and the use of online platforms and networks.

Source: (OECD, 2010[137]); (OECD, 2015[138]); (OECD, 2011[139]); (OECD, 2019[140]); (OECD, 2011[6]).

The ***tax system*** is an important factor firms consider when deciding whether to invest domestically or abroad, and can distort competition and resource allocation if cross-border firms have a competitive advantage over domestic firms through international tax planning. Digital transformation has a wide range of implications for taxation, affecting tax policy and tax administration at both the domestic and international levels, offering new tools and introducing new challenges for policy makers. As a result, the digitalisation of the economy has been at the centre of the recent global debate over whether current international tax rules are fit for purpose in an increasingly global business environment.

Under the auspices of the OECD/G20 Base Erosion and Profit Shifting (BEPS) Project and the Inclusive Framework on BEPS, work has been undertaken that recognises that digitalisation and some of the business models that it facilitates present important challenges for international taxation (OECD, 2015[141]). This analysis acknowledges that it would be difficult, if not impossible, to "ring-fence" the digital economy from the rest of the economy for tax purposes because of the increasingly pervasive nature of digital transformation.

This work has also identified a number of key features of digital transformation that are potentially relevant from a tax perspective. There was recognition that digital transformation has also accelerated and changed the spread of GVCs in which multinational enterprises integrate their worldwide operations. More specifically, new phenomena such as the collection and exploitation of data, network effects and the emergence of new business models, such as multi-sided platforms, were identified as exacerbating the challenges to existing tax rules (OECD, 2018[142]).

Building on the 2015 Action 1 Report, an Interim Report on the Tax Challenges Arising from Digitalisation was delivered to the G20 Finance Ministers in March 2018. The Interim Report presents an in-depth analysis of value creation across different digitalised business models, and describes the main characteristics of digital markets (OECD, 2018[142]). These have significantly evolved, especially for some enterprises. In particular, it identified three characteristics that are frequently observed in certain highly digitalised business models: 1) scale without mass; 2) reliance on intangible assets; and 3) data and user contributions. Further, it was acknowledged that these characteristics are expected to become common features of an even wider number of businesses as digital transformation progresses.

Ensuring that tax systems are ready to meet the changes brought about by the increasingly global business models enabled by digital transformation, as well as to leverage its opportunities and provide protection from its potential risks, is a critical challenge. The impact of digital transformation on the international tax system will be a significant component of this work, and has important ramifications for multinational enterprises and governments, as well as the future of tax systems. Members of the Inclusive Framework on BEPS have agreed to undertake a coherent and concurrent review of the two key aspects of

the existing tax framework – the profit allocation and nexus rules – that would consider the impacts of digital transformation on the economy, relating to the principle of aligning profits with underlying economic activities and value creation.

The Inclusive Framework has now commenced this important next phase of the work and is working towards a consensus-based, global solution. The latest OECD proposal brings together common elements of three competing proposals from Member countries, and is based on the work of the OECD/G20 Inclusive Framework on BEPS, which groups 134 countries and jurisdictions on an equal footing, for multilateral negotiation of international tax rules (OECD, 2019[143]). The proposal is open to a public consultation process.

Strategy

Putting a whole-of-government approach to digital transformation into practice requires a Digital Transformation Strategy (DTS). Many countries have a digital economy strategy or an equivalent policy in place, but most of these are still rather narrow in scope (OECD, 2017[13]). A DTS should be comprehensive in addressing the range of inter-related policy issues discussed above, ensure coherence and co-ordination of policies across all domains and sectors that shape digital transformation, and involve all relevant stakeholders in its development and implementation. This section discusses key aspects of governing, developing and implementing a DTS.

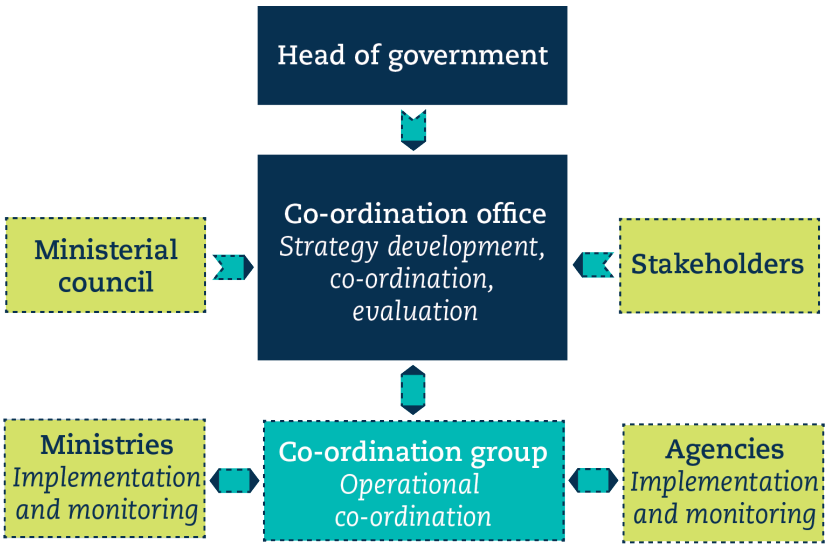
Establish a governance approach that supports effective co-ordination

Digital transformation policies need to be co-ordinated among all policy domains and actors affected by and affecting digital transformation. Co-ordination is critical for the coherent design and effective implementation of cross-cutting policies (OECD, 2015[58]). Such co-ordination implies involving a wide range of actors in multiple parts and at different levels of government, as well as non-governmental stakeholders and international partners.

Governments need to adopt a governance approach to digital transformation policies that ensures effective co-ordination. Approaches can differ significantly across countries, reflecting domestic institutions, administrative organisations and culture, and may evolve over time. One distinguishing characteristic of any governance approach is the allocation of responsibility for strategic co-ordination, which tends to be either at above ministerial level, usually with the head of government, or at the level of a lead ministry.

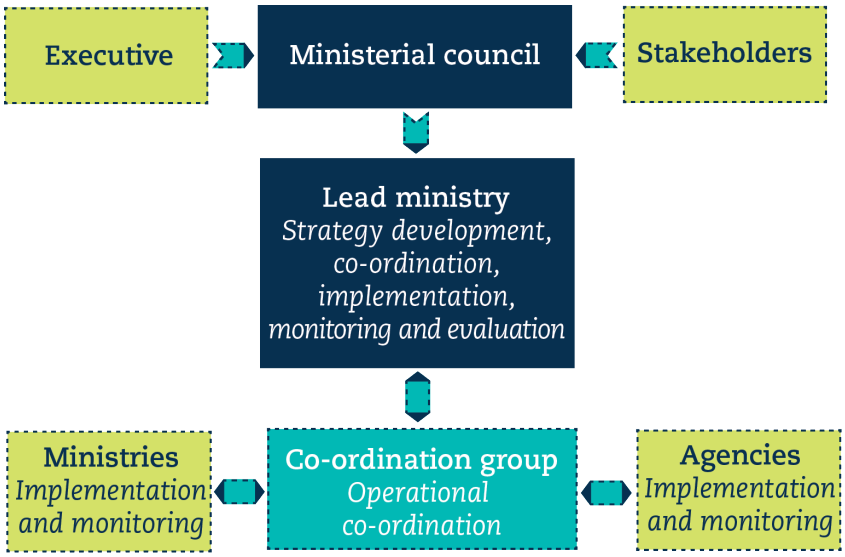
A small group of OECD countries centralises responsibility for strategic co-ordination above ministerial level, i.e. in most cases with the head of government (Figure 2). In these countries, the Prime Minister's Office usually holds the pen in drafting the strategy and involves key ministries and stakeholders in the process. Operational co-ordination for the implementation of the strategy tends to be ensured via focal points (e.g. chief digital officers) in each of the implementing ministries and agencies. The latter usually also monitor implementation and report to the central co-ordinating office for evaluation.

Figure 2. High-level strategic co-ordination of digital transformation policies



In a larger group of OECD countries, one lead ministry is in charge of strategic co-ordination, overseeing strategy development and implementation (Figure 3). Some of these countries have a dedicated digital affairs ministry. Strategy development tends to involve stakeholders, under the auspices of a ministerial council, which is usually hosted by the lead ministry and sometimes chaired by the head of government. In most countries, a co-ordination group, made up of focal points in implementing ministries and agencies, ensures operational co-ordination of the strategy's implementation. The latter also tends to monitor implementation and report to the lead ministry and/or the ministerial council for evaluation.

Figure 3. Ministry level strategic co-ordination of digital transformation policies



Articulate a strategic vision and ensure coherence

To develop a coherent DTS, it is important to articulate a strategic vision (or direction) for the digital transformation of the country. A strategic vision should clarify how digital transformation contributes to reaching overarching objectives such as inclusive growth, well-being and sustainable development, and how it can help address "grand challenges" such as health care and climate change. Such a vision also helps shape strategic priorities and can facilitate coherence with other national and/or international agendas such as the United Nations' Sustainable Development Goals or the Digital Agenda for Europe.

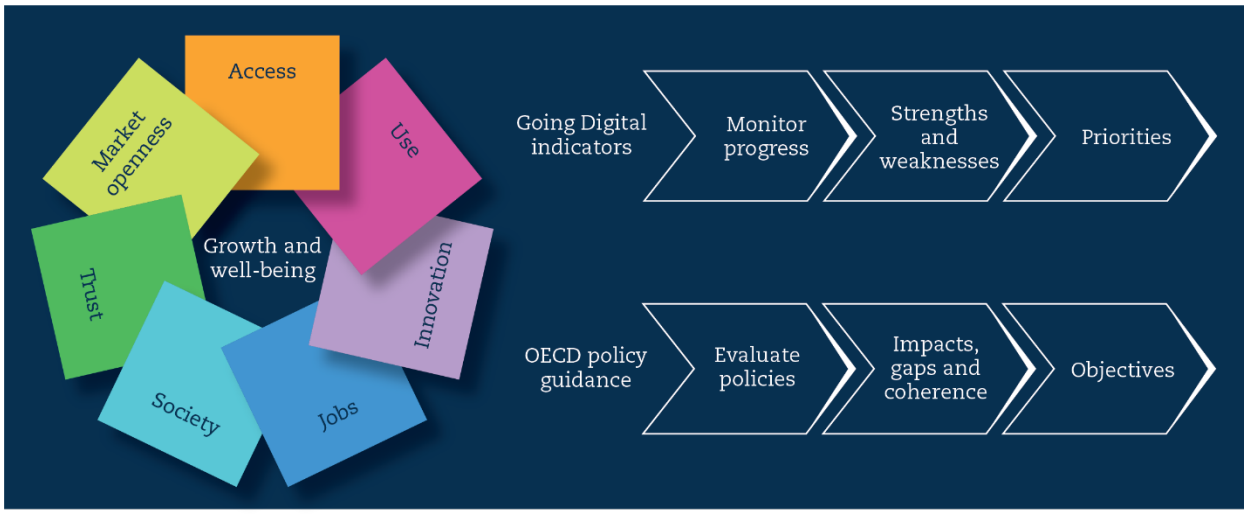
The DTS also needs to be co-ordinated with existing national strategies in key areas of the DTS, such as broadband development, digital security, innovation, skills and jobs. It is important to identify possible synergies with other strategies and avoid conflicting approaches. In addition, sub-national digital economy/transformation strategies and/or policies should complement the national DTS.

Assess key digital trends, related policies and regulations

Understanding a country's state of digital development requires comprehensive monitoring and analysis of relevant trends and evaluation of related policies. Any new strategy should require monitoring and evaluation to improve the quality, legitimacy and effectiveness of policies and expenditures (OECD, 2015[58]). Measurement, monitoring and evaluation allow policy makers to: 1) assess progress, 2) understand drivers of and obstacles to digital transformation, and 3) evaluate the effectiveness of past and current policies. Resulting insights are essential to make informed decisions about strategic priorities, the choice of policy measures and instruments, and the allocation of funds.

This framework provides guidance on the policy domains that governments should consider for monitoring and evaluation (Figure 4). In addition, the Going Digital Toolkit helps countries self-assess and benchmark domestic trends internationally with a set of key indicators for each of the seven policy dimensions of this framework. The Going Digital Toolkit also provides OECD analysis and policy guidance on key issues to be addressed by a DTS and identifies innovative practices from across countries that can help formulating a DTS.

Figure 4. Assessing where your country stands: Monitoring and evaluation



Enable inclusive strategy development

Leveraging a governance approach that supports effective co-ordination, a strategic vision that ensures coherence, and insights from monitoring and evaluation that underpin strategic priorities and objectives, the development of the DTS should be inclusive of all relevant stakeholders. Involving stakeholders is essential, e.g. to vet priorities and objectives, to identify and/or design appropriate policy measures, and develop an action plan for successful strategy implementation. Key actors to involve include officials from all relevant parts and levels of government, international partners, and non-governmental stakeholders, including business associations, civil society organisations, trade unions, and technical and scientific communities (Box 15).

Box 15. The Multi-stakeholder model: A key to good policy making in the digital age

Government actors involved in drafting a strategy and designing policies can never by themselves have a full view and understanding of all opportunities, challenges and issues to be considered in a DTS. A key to a successful strategy and its implementation is thus the engagement of stakeholders from the early stages of strategy and policy development. Multi-stakeholder co-operation brings tangible benefits that lead to better policies and outcomes.

Regulatory policy making is one area in which stakeholder engagement is well developed in many countries. Stakeholder engagement in regulatory policy making helps ensure that regulation is user-centred and in the public interest. It improves the quality of rulemaking through ideas, expertise and evidence from stakeholders, and creates a sense of ownership in and enhances the legitimacy of policies and regulations. In turn, stakeholder engagement can increase trust in government and compliance with regulations.

An example of successful international stakeholder engagement is the OECD's practice of broad stakeholder consultation to enrich debates, shed new light on complex issues, and ultimately enable better policy outcomes. Being rather unique among its peers, right from the beginning the OECD established institutional relations with trade unions and business through two advisory committees: Business at OECD (BIAC) and the Trade Union Advisory Committee (TUAC). In 2008, the Civil Society Information Society Advisory Council and the Internet Technical Advisory Committee were formally recognised in the work of the Committee on Digital Economy Policy. The OECD Recommendation of the Council on Principles for Internet Policy Making (OECD, 2011[6]) recommends all adherents to "encourage multi-stakeholder co-operation in policy development processes".

Source: (OECD, 2011[6]); (OECD, 2017[144]); (OECD, 2018[145]).

International partners can also play an important role in determining outcomes of a DTS. Issues on which international public or private partners may be consulted include trade, cross-border data flows, foreign direct investment, regulation, and Internet governance. While some of these may be addressed in the context of multilateral co-operation and agreements, for example in multilateral institutions, other issues may be agreed upon in bilateral co-operation, formal agreements, treaties or standards.

Implement the strategy successfully

The main value of any strategy lies in its successful implementation. Even if a DTS is well co-ordinated, challenges to implementation may arise, for example, from poor strategy

design, such as unrealistic objectives, or from rigid institutions and organisational structures that impede efficient resource allocation and effective action. Existing policy frameworks and social preferences can also hinder implementation (OECD, 2015[58]). Administrative capacity, a clear division of labour, and complementarity among different parts and levels of government are crucial for successful implementation.

Another important condition for successful implementation is broad-based support for the strategy. Effective communication, constructive negotiation, and co-operation with stakeholders during the implementation, is crucial. In addition, the targeting and sequencing of measures must be well-thought through, e.g. by acting first on those that are a prerequisite for the success of others to minimise trade-offs and enable synergies between policies (OECD, 2018[80]). More effective use of digital technologies can also contribute to successful implementation (OECD, 2019[146]).

Putting strategic objectives into action requires a sufficiently detailed translation into specific policy measures and instruments, generally provided by an action plan. Measures and instruments include advocacy (e.g. awareness raising and education), investment, incentives and/or taxation, public services and programmes, and legislation and/or regulation, among others. Importantly, for each measure the action plan should allocate clear responsibility. This concerns not only officials and departments in ministries, agencies and other bodies implementing the strategy, but also non-governmental stakeholders, e.g. in the case of PPPs.

All policy measures in the action plan that involve public spending or investment should identify the required amount and the source(s) of funding. While most OECD governments have a budget associated with their current digital strategy, approaches to budgeting differ widely across countries (OECD, 2017[13]). For example, some countries have a budget specifically dedicated to their digital strategy, while others rely on the budget lines of implementing ministries and agencies. In few countries, the entity in charge of overall co-ordination has a budget to (co-)finance measures under certain conditions, which can permit additional steering and can be used to incentivise co-operation among different implementing actors (OECD, 2018[3]).

Successful implementation of a DTS also crucially depends on relevant skills and capacity of the key actors and institutions responsible for the strategy. In addition to the mix of skills needed for work (see Use and Jobs) and life (see Society) in the digital age, specific skills for high-performing civil service and innovation in the public sector are essential. These include skills to influence the policy agenda, identify policy problems, develop policy, and design solutions; skills to manage networks and projects and to engage with stakeholders; as well as co-ordination, communication and conflict resolution skills (OECD, 2017[147]).

Finally, a successful strategy requires a clear time-frame for implementation and quantifiable targets with related indicators to monitor progress. Progress towards the main objectives of the strategy should be monitored using the targets stipulated by the action plan; progress towards other related domestic and international high-level policy objectives may be monitored as well. Some countries also link the timeline for implementation with their annual budgets and periodically re-assess their initial budgetary assumptions and revise as needed. At the end of the strategy's implementation cycle, systematic assessment and evaluation should be the basis of updating the existing strategy or preparing a new one.

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Endnotes

[1] http://www.oecd.org/going-digital-toolkit.

[2] The OECD has identified key properties – or "vectors" – of the digital transformation that fundamentally affect the economy and society and accordingly the design and efficacy of public policies (OECD, 2019[5]). The seven vectors provide insights on how the transformation challenges policies that are frequently predicated on an analogue world of tangible products and assets, fixed geographic boundaries and physical locations, on transaction costs that limit the scale and scope of interactions and offerings, and on supply and demand conditions that reflect scarcity.

[3] One potential challenge for the future of the Internet is its ability to scale to connect tens of billions of devices and machines, and a key aspect of that scalability is the use of the Internet Protocol. The Internet Protocol specifies how communications take place between one device and another through an addressing system. There are two versions of the Internet Protocol in use, one which is largely exhausted in terms of the distribution of unassigned addresses (IPv4) and another that is plentiful but has had a slower than desirable rate of adoption (IPv6) (OECD, 2014[10]).

[4] ICT skills are also referred to as digital skills.

[5] ICT skills used at work range from basic computer skills to communication and information search and office productivity software skills.

[6] ICT specialists include ICT service managers, ICT professionals, ICT technicians, electro-technology engineers, and electronics and telecom installers and repairers.

[7] Data specialists include mathematicians, actuaries, statisticians, and database and network professionals.

[8] Complementary skills include teamwork and autonomy, among others.

[9] Skill distances between different jobs are measured in terms of underlying skill needs and task contents of different jobs.

[10] E-government refers to the use by the governments of information and communication technologies, and particularly the Internet, as a tool to achieve better government.

[11] Digital government refers to the use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value. It relies on a digital government ecosystem comprised of government actors, non-governmental organisations, businesses, citizens' associations and individuals, which supports the production of and access to data, services and content through interactions with the government.

[12] The 'once only' principle seeks to ensure that individuals, institutions, and companies only have to provide certain standard information to public authorities once.

[13] Digital security includes the protection of critical activities, and risk transfer mechanisms such as cyber insurance.