Chapter 6. Policies to support lifelong and countrywide learning for a digital world

This chapter considers two policy objectives that have a key role to play in making the most of the digital transformation: fostering lifelong learning and ensuring geographical inequalities do not exacerbate. Lifelong learning is critical so that all workers and citizens can adapt to changes at work and changing societies. Strong lifelong learning systems rely on a combination of policies that provide high-quality education and training for all, anticipate changes in the demand of skills and ensure that education and training systems are well aligned with labour market needs. Policies are also needed that facilitate mutually reinforcing local benefits of skills and technology in order to prevent the magnification of regional differences. While different in nature, the need to foster lifelong learning and the need to prevent geographical inequality both require a comprehensive approach to the digital transformation that co-ordinates a range of policies and actors.

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

New technologies profoundly change the world of work (as Chapter 2 showed) as well as societies (Chapter 4). To adapt to these changes, people need to be able to learn and adjust their skills set throughout life. Policies that facilitate and encourage lifelong learning for all are at the core of the policy response to the digital transformation and, in particular, the uncertainties it creates about future skills needs. Strong lifelong learning systems require a combination of targeted policies that ensure high quality education and training is accessible to everyone, at all stages of life and including all types of learning. Successful lifelong learning also relies crucially on policies and tools that anticipate skills required in the future and ensure that education and training systems are well aligned with labour market needs.

Policy makers also need to take into account the fact that digital transformation affects regions within countries differently. The digital transformation tends to exacerbate existing gaps between regions' skills endowments. A range of policies, centred on skills, is necessary to help lagging regions catch up and ensure that the benefits of digital transformation are shared equally within countries.

The need to foster lifelong learning and the need to offset the unequal geographical impact of the digital transformation are different in nature. But each requires a comprehensive approach to digital transformation and the co-ordination of a range of policies and actors. This co-ordinated policy effort goes beyond the need for specific skills policies that address changes in the world of work (discussed in Chapters 2 and 3) and in societies (discussed in Chapter 4), as well as policies that make the most of technology to foster learning inside and outside schools (Chapter 5).

This chapter first reviews policies that foster lifelong learning in an increasingly digitalised world. The second section examines the geographic dimension of digitalisation and policies that can help all regions benefit. The third section outlines a policy package that can help countries make the most of digitalisation and the co-ordination necessary to implement these policies.

The main findings from the chapter are:

Co-ordinating policies that foster lifelong learning for all

- Enabling life-long and life-wide learning for all is a crucial policy response to changing skills requirements and the uncertainty of future skills needs.
- Policies need to raise the quality of education and training opportunities throughout life. For initial education, this means adapting the school curriculum to changing skills requirements and training teachers to face these changes. For adult education and training, it is vital to ensure that programmes respond to labour market needs at the country and local levels, to set standards for non-formal education and training, and to assess it better.
- Policies need to make learning opportunities much more flexible and responsive to labour market needs through appropriate funding mechanisms, skills assessment information and effective career guidance.

Co-ordinating policies that offset the unequal geographical impact of digitalisation

- Digitalisation affects regions within countries differently, and exacerbates the existing gaps between regions' skill endowments. Technology-intensive firms and industries, and high-paying jobs, are drawn to regions with high-skilled workers. High-paying jobs further attract high-skilled workers.

- Skills-related policies can help lagging regions catch up. High-quality early childhood education is crucial to bridge skills gaps that can emerge at an early age between children of different socio-economic status and different geographic location. Disparities between regions in secondary students' performance also need to be addressed.
- High-quality higher education institutions can increase demand for and supply of high-skilled individuals when entrepreneurial ventures are located close to the cutting-edge research that they rely on. They also enable skilled individuals to be more mobile geographically, reducing unused productive capacity in declining areas and closing income gaps. However, higher education institutions are very unequally distributed within countries.
- A wide range of policies is necessary to help lagging regions catch up:
    - High-quality vocational education and training that has a strong work-based learning component and is aligned with local labour market needs can foster local development while raising young people's employability.
    - Distance-based financial aid, information policies, role models and mentoring can bridge the educational aspiration gap that separates students who are far from a university and those who live nearby.
    - Geographical labour mobility, which has been in decline in some OECD countries, needs to be improved to match job opportunities with workers' skills. This can be achieved by changing inefficient land use regulations, moderating the tax bias towards home ownership, revisiting and possibly harmonising local social transfers, and providing financial assistance to displaced workers in order to mitigate migration costs.
    - Investments in digital infrastructure are essential so that advanced technologies can be adopted and rural areas and remote territories can enjoy the benefits of digitalisation.

Co-ordinating policies across areas

- Digitalisation has wide-ranging effects on economies and societies and requires a package of co-ordinated policy responses that go beyond learning. These need to promote digitalisation where it increases productivity and well-being while cushioning its negative impacts.
    - Labour market policies and institutions that balance flexibility and worker protection, particularly for workers in non-traditional working arrangements, can facilitate mobility and the efficient allocation of workers to jobs and sectors. At the same time they can encourage high-performance work practices and ongoing learning.
    - Tax policies can offer incentives for undertaking and providing learning. Research and innovation policies can unlock the potential of digital technologies for economic and social well-being, while regional and local development policies can help spread the benefits of digitalisation.
    - Housing policies can enhance worker mobility, while migration policies can increase countries' attractiveness in the global competition for talent. Policies that support infrastructure, both physical and digital, are important to ensure that everyone has access to learning opportunities.

  - Social protection policies are vital to shield workers from the risks of digitalisation. They may need to evolve from a last resort to a broader safety net as a wider range of workers navigates more frequent and more complex work transitions.

- The geographical impact of digital transformation requires co-ordination of policies across levels of government. For instance, adult learning policies at the local level can be co-ordinated with regional development strategies.
- Several countries have put in place strategies to co-ordinate policy concerning the digital transformation. However, few of these strategies seem to have the necessary level of government engagement, breadth of policy coverage and concreteness of policy responses.

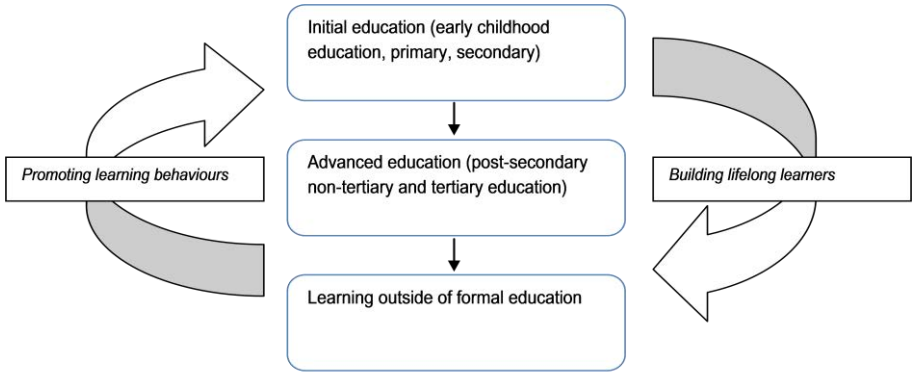
Fostering lifelong learning in a context of uncertainty

The rapid pace of change at work and in society brought about by digitalisation requires flexible learning systems that are both lifelong (accessible to all at any age) and life-wide (that promote and recognise learning acquired outside of formal education systems). Policies that favour such flexible systems are crucial to meet changing skills needs and manage the uncertainties surrounding these changes.

OECD countries have recognised for several decades the economic and social benefits of knowledge and skills for individuals and societies (OECD, 2001[1]; OECD, 2013[2]). In recent years, the focus has shifted to the necessity for individuals to maintain, improve and adjust their skills throughout life in response to globalisation and the digital transformation of the economy (IMF, 2017[3]; OECD, 2017[4]; OECD, 2017[5]).

Lifelong learning systems include all stages of education and learning, "from cradle to grave", within the formal education system and outside of it (OECD, 2001[1]). Such systems facilitate the mobility of learners between different levels and types of education and training, departing from a traditional conception of education as mainly formal and organised in successive levels without interaction between them (Figure 6.1).

Figure 6.1. Lifelong learning systems: Key features



Countries have a highly diverse range of approaches to designing and implementing lifelong learning systems. These often depend on countries' institutional settings, such as the role of the government in funding and delivering education, and the level of engagement in education and training of social partners such as employers and trade unions (Saar and Ure, 2013[6]).

Rationale for supporting lifelong learning in a digital world

A high level of skills and a diversified skill set can help individuals be resilient in the digital economy. Workers in digitalised workplaces use a range of cognitive and non-cognitive skills more intensively than in non-digital workplaces (Chapter 2). The digital transformation goes well beyond the world of work, affecting many aspects of daily life. Students, parents, consumers and citizens need to have the skills to access, filter and process information, to perform the tasks that can be done through the Internet and to benefit from the new opportunities offered by the digital era (Chapter 4).

At the same time, digital transformation is characterised by an accelerated pace of change, and uncertainty in how and how fast technology will spread throughout countries. Putting too much emphasis in initial and advanced education on the development of specific skills that are important today (such as specific ICT ones) could lead to a high rate of skills mismatches among workers if these skills are no longer needed when this cohort enters the labour market. Workers and people lacking the readiness to learn face bigger risks of being displaced at work and feeling excluded from societies. In this context, lifelong learning is a crucial policy response to the uncertainty about future skills needs. As workers and citizens, people have to be able to adjust their skills sets continuously to new needs.

Although a diversified skillset can help individuals be resilient in digital economies and societies, labour markets demand students and workers who are specialised in some knowledge areas and have specific skills. Policies that support the provision of accurate, updated and usable information about labour market and skills needs are a key foundation for effective lifelong learning systems. It is also crucial to ensure that education and training systems are flexible enough to integrate this new information and react to changing skills needs.

Information on skills can decrease uncertainty, but only if it reaches individuals and informs their actions. Adults who report being interested in learning and who engage most in learning tend to have high levels of education and skills, to be younger, employed, in higher positions in their firms, and in larger firms (OECD, 2005[7]; Cedefop, 2015[8]; OECD, 2018[9]). That means special efforts need to be made to convey information on skills effectively to those who are likely to need it most, such as low-skilled individuals most at risk of job transformation or displacement.

Promoting high-quality lifelong learning for all

To prepare students to succeed in a complex and digitalised world, OECD countries are deepening and broadening what students learn in formal education. This important strategy acknowledges that strong cognitive skills acquired early in life are a foundation for developing well-rounded skills and fostering interest in continuing to learn throughout life.

Many countries are focusing on teaching new competencies from an early age. The number of countries that include in the pre-primary curriculum skills concerning health and well-being rose from 50% in 2011 to close to 90% in 2015, ethics and citizenship from less than 20% to 80%, ICT skills from less than 10% to 40% and foreign languages from less than 5% to 40% (OECD, 2017[10]).

In primary and secondary education as well, the broadening of the curriculum has focused on a range of skills, including digital competence, creativity, the ability to think critically and openly, and the ability to act ethically. Since 2012, the teaching of "computing" – which covers computer science, digital literacy and information technology (IT) – has been compulsory in English schools from ages 5 to 16,. Portugal introduced in 2017 a guidance document to be followed by all schools that sets out the knowledge, competencies and values to be acquired by all students upon completing upper secondary education. The guidance focuses on the ability to navigate a complex world competently through critical thinking, resilience and the ability to learn throughout life. Initiatives to expand the curriculum need to be carefully balanced, however, with the risk of overburdening children (OECD, 2018[11]).

In countries that have incorporated ICT skills in the curriculum, teachers need training in ICTs and often report this need. For instance, a review of the ICT curriculum in England highlighted the need to improve the attractiveness of the teaching profession for professionals with ICT skills, to provide more relevant continuous training for current teachers, and to create qualifications recognising immediate levels of ICT skills (The Royal Society, 2017[12]).

For over a decade, countries across the OECD have been tackling the need for teachers to develop ICT skills through a range of policies, from developing national plans promoting this goal, to introducing compulsory training, national accreditation standards or national certification for teachers. Denmark, for instance, has developed a voluntary Pedagogical ICT Licence that combines pedagogical knowledge of ICTs and basic ICT skills training, and has become a European standard in the provision of ICT skills to teachers. Implemented at first for in-service training, this approach was expanded to initial teacher education and general upper secondary education. While not mandatory, the licence is integrated into the curriculum of student teachers who graduate from teacher education colleges (Rizza, 2011[13]).

Policies that encourage the development of high-quality, equitable primary and secondary systems play a vital role in equipping all youth with key skills that form the foundation for learning in a digitalised world. Several policy approaches have been identified that foster quality education systems: well-designed curricula; early and targeted interventions to equip youth, especially those facing barriers, with key cognitive skills; a well-trained teaching workforce prepared to deal with an increasingly diverse student body and to teach new types of skills; and measuring quality by focusing on the outcomes of education rather than on how much spending has increased (OECD, 2018[14]). Similarly, policies that encourage universal participation in primary and secondary education include extending the duration of compulsory education to 18 years of age, in countries such as Belgium, Chile, Germany, the Netherlands or Portugal; enforcing school attendance; identifying students lagging behind as early as possible; and concluding agreements between national and local authorities to combat school dropout, as in the Netherlands, or reduce grade repetition, as in Portugal.

Vocational and educational training (VET) should be closely aligned with the needs of the labour market and flexible enough to adapt to the rapid changes taking place in the working environment. Since the labour market is demanding higher levels of skills, the traditional VET system aimed at manual and routine jobs has become outdated. Modernised VET systems should prepare students with a broad range of performance levels for an increasingly demanding labour market. VET systems need to ensure high-quality foundation skills and work-based training so that students develop a broad range of skills, from cognitive to technical ones.

It is also important that there are flexible pathways between VET and the academic/general track, so that students can move from one to the other. Countries such as Singapore and the Netherlands have VET systems that equip students with a broad and high level of skills, and have designed flexible systems with several paths that are offered at early ages; these models have shown to be compatible with achieving high quality and equity.

Ensuring equal access to higher education is vital to help people adapt to a digital world of work. The share of people aged 25-34 holding a tertiary degree has increased to 40% on average in OECD countries. In many countries, however, there remain large gaps in access between students with lower and higher socio-economic status. Policies to improve access include financial assistance; information and guidance; and academic and other support to help students enter and complete higher education (OECD, 2008[15]; Jongbloed and Vossensteyn, 2016[16]).

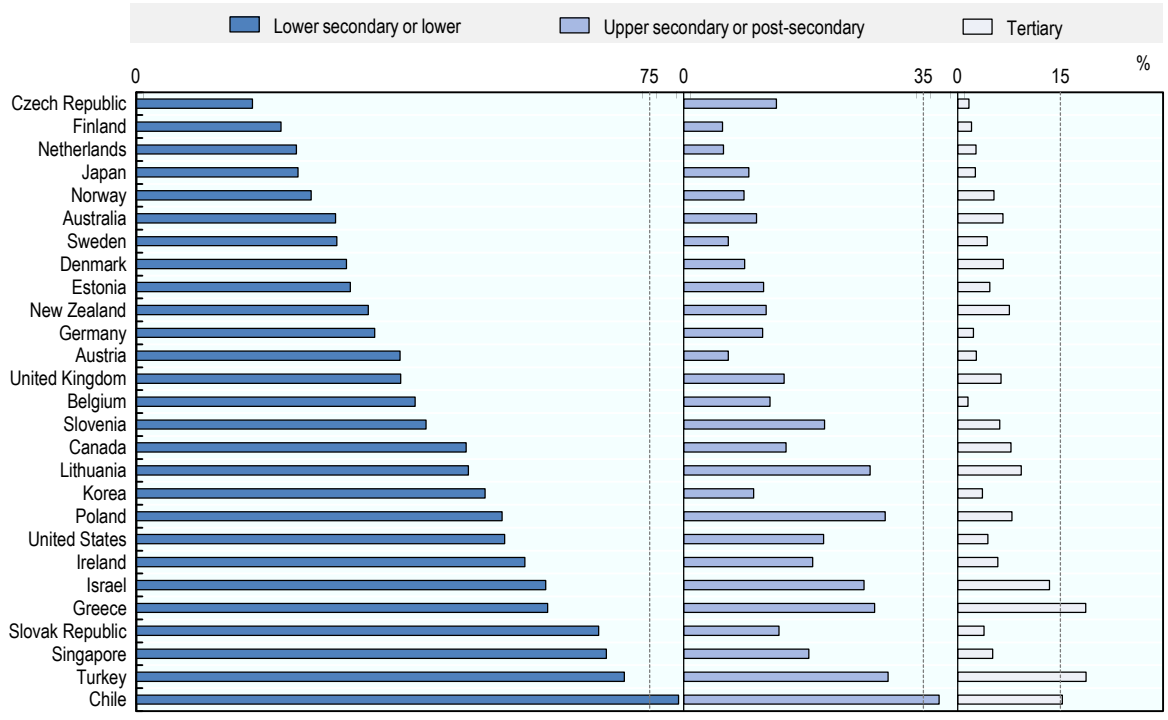
Helping students understand the labour market relevance and returns of higher education can also encourage participation and decrease uncertainty, particularly for groups who may be hesitant to invest in learning after secondary education. Australia and the United Kingdom, for instance, have government-sponsored websites that provide detailed information, including student satisfaction by programme, graduates employment outcomes and employers' views on the attributes of recent graduates (OECD, 2018[17]).

Information alone is not always sufficient to motivate students to enter higher education, however, especially those from low-income families. Several recent randomised field experiments in the United States and Canada show that assistance with applying for higher education and financial aid, provided at times where individuals have to be present (e.g. during class when targeting students, or during a meeting with a tax accountant when targeting parents) can boost rates of application to, and enrolment in, higher education (Oreopoulos and Ford, 2016[18]; Bettinger et al., 2012[19]).

Holding a tertiary degree does not always guarantee a high level of skills, however, as the quality of education systems and educational outcomes varies within and across countries. On average, around 7% of those aged 20-34 with a tertiary education degree lack basic skills, and more than 43% of those with at most lower secondary education (Figure 6.2). There are important variations between countries, especially regarding the share of young adults with lower secondary education who lack basic skills. Getting most pupils through secondary education, raising the quality of lower secondary education to that of the best performers (Denmark, Finland, Japan, the Czech Republic and the Netherlands) and improving the quality of some tertiary programmes would reduce the incidence of basic skills deficits.

Figure 6.2. Education levels linked with lacking basic skills

Share of 20-34 year-olds lacking basic skills, by education level, by country and education level (%)



Note: Individuals lacking basic skills score at most *Level 1* (inclusive) in literacy and numeracy and at most *Below Level 1* (inclusive) in problem solving (including failing ICT core and having no computer experience). The three education categories are constructed from the 1997 International Standard Classification of Education (ISCED): 1) Lower secondary or less (ISCED 1, 2, 3C short or less), 2) Upper secondary or post-secondary (ISCED 3A-B, C long, 4A-B-C), 3) Tertiary (ISCED 5B, 5A, 5A/6). Chile, Greece, Israel, Lithuania, New Zealand, Singapore, Slovenia and Turkey: Year of reference 2015. All other countries: Year of reference 2012. Data for Belgium refer only to Flanders and data for the United Kingdom refer to England and Northern Ireland jointly.

Sources: OECD calculations based on OECD (2012[20]), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis and OECD (2015[21]), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis

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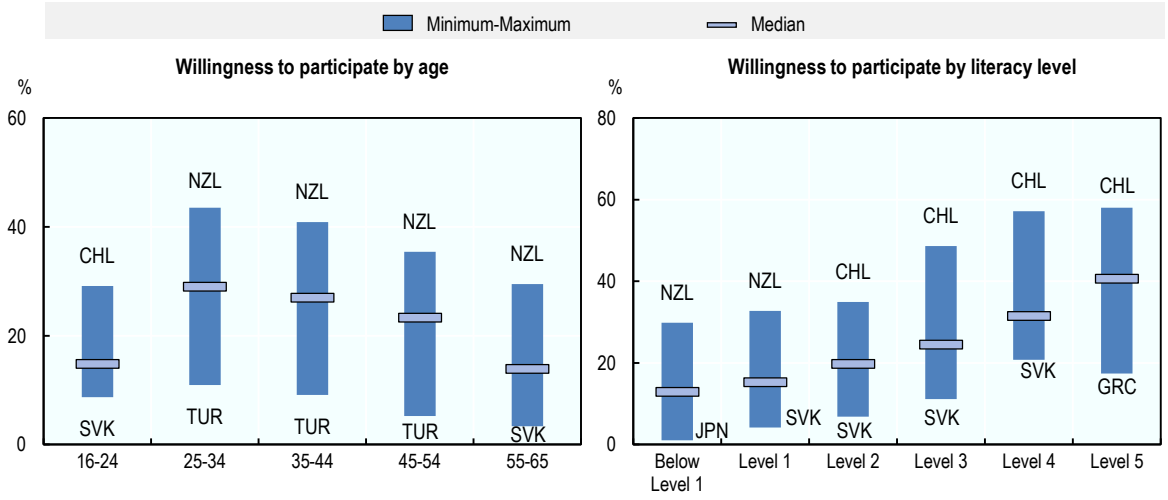
Overcoming the barriers to learning in adulthood is critical to deal with fast-changing skills demand. Adults have an increasing array of learning options, including formal education, short non-formal learning opportunities, informal learning on the job, and online learning opportunities such as MOOCs (Chapter 5). However, most adults report not being interested in learning. Of those who report interest, many identify the cost of learning as a reason not to engage in learning, along with a lack of time, of suitable and accessible options, or of employer support. The willingness to engage in learning varies significantly by age and skill level, and across countries (Figure 6.3). Evidence suggests that workers more exposed to the risk of automation are less likely to participate in training (Figure 6.4).

Figure 6.3. Willingness to participate in adult learning by age and skill level



Sources: OECD calculations based on OECD (2012[20]), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis and OECD (2015[21]), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis.

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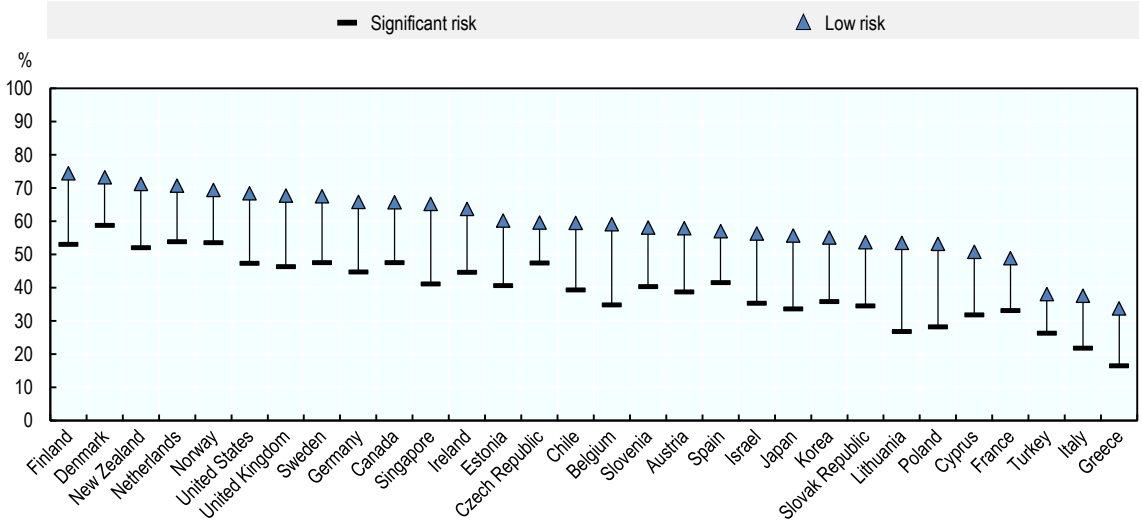
Many countries have thus developed a range of policies to promote lifelong learning, including: i) raising awareness of the returns of skills through targeted information and guidance, ii) creating flexible, shorter, modular types of learning opportunities, recognised as part of national qualifications framework, iii) improving the labour market relevance of adult learning opportunities, even when they target the acquisition of basic cognitive skills, iv) recognising prior learning, and v) a range of learning, financial and social supports to address specific barriers to learning faced by low-skilled and disadvantaged adults (Windisch, 2015[22]; European Commission, 2015[23]).

Policies that promote more efficient use of skills can help workers improve their skills while increasing firms' productivity and employees' wages. In Australia and Canada, these practices are often developed by firms as part of their human resources strategies. In Nordic countries, governments work with employers and employees' organisations to develop effective skills utilisation approaches and workplace innovations that can help boost both productivity and worker well-being (Stone, 2011[24]).

Enhancing participation in learning by adults who are either unemployed or outside of the labour force, or who are self-employed or employed in the "gig economy", requires an effective package combining employment protection legislation and active labour market policies, as well as social protection and taxation systems. This is discussed later in the chapter.

Figure 6.4. Participation in job-related adult learning by risk of automation

Share of workers participating in adult learning (in the last 12 months)



Note: Significant risk is defined jobs with a risk of automation over 50%, low risk as jobs having a risk of automation of at most 50%. Belgium refers to Flanders only, United Kingdom to England and Northern Ireland. Training refers to formal or non-formal job-related adult learning.

Note by Turkey:

The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

Note by all the European Union Member States of the OECD and the European Union:

The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Sources: Nedelkoska and Quintini (2018[25]), "Automation, skills use and training", https://doi.org/10.1787/2e2f4eea-en (accessed on 05 February 2018), using PIAAC data in OECD (2012[20]), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis and OECD (2015[21]), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis.

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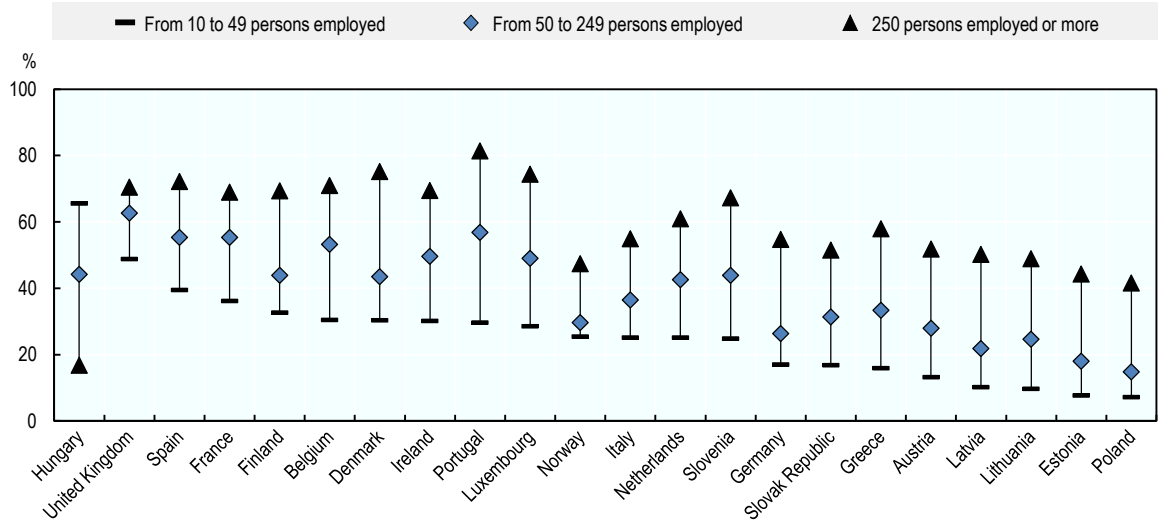
Anticipating changes in skills needs and guiding careers in a digital world

In an increasingly digitalised world of work, policies and tools to assess current skills needs and predict skills that may be in demand in the future are of crucial importance. A widespread approach in OECD countries consists of assessing and forecasting sector-specific and occupation-specific skills based on projections of employment needs, through skills assessment and anticipation (SAA) systems. Strong SAA systems need to *i)* define clear objectives for SAA exercises, *ii)* systematically use several quantitative and qualitative sources, and *iii)* involve various stakeholders in the production, dissemination and effective use of skills needs information (OECD, 2016[26]; OECD, 2017[27]; ILO, 2017[28]).

Mechanisms are necessary that ensure the information produced feeds into policy-making, is taken into account for education and training decisions, and reaches main actors. Evidence from some European countries shows that small firms are much less likely than big ones to assess their future skills needs (Figure 6.5). Providing information on future skills needs to firms at occupation or industry level – including to small firms – might help them make better training and recruitment decisions for the future.

Figure 6.5. Enterprises that assess their future skill needs by size group

Percentage of all enterprises, excluding those with less than 10 employees



Note: Share of enterprises declaring they "always" assess their future skills needs.
Source: Eurostat (2015[29]), *Continuing Vocational Training Survey (CVTS)*, https://ec.europa.eu/eurostat/web/education-and-training/data/database.

StatLink http://dx.doi.org/10.1787/888933974710

To facilitate co-ordination among stakeholders, the central government plays a lead role in countries such as France, South Africa, and the United Kingdom. In Portugal, a joint agency of the Ministry of Education and the Ministry of Labour, Solidarity and Social Security oversees the SAA system in collaboration with municipal authorities (OECD, 2018[30]). Other countries, such as Canada and the Czech Republic, use Sector Skills Councils to co-ordinate the production and use of skills needs information. In 2018, Canada launched the Future Skills initiative to develop and assess new approaches to identifying emerging skills that are in demand and options to improve the effectiveness of jobs and training programmes (Government of Canada, 2018[31]). An objective is to share innovative approaches to these issues in close co-operation with several stakeholders, including representatives from the manufacturing industry. The initiative includes a Future Skills Centre to bring together expertise on these domains and a Future Skills Council that will report to the Minister of Employment, Workforce Development and Labour.

Exercises that anticipate growing occupations and future skills needs can be complemented by studies on training policies to facilitate transitions between occupations (Chapter 3). To offset the impact of new technologies on occupations, cost-effective training policies should help workers move to occupations that have lower risks of automation and are not too different from occupations of origin in terms of skills requirements, knowledge area and the tasks performed on the job.

Policies supporting career guidance are key to transform information on skills needs into knowledge that can inform learners' decisions. Emerging evidence suggests career guidance can help improve the employment and earnings of participants, boost educational outcomes, and improve self-confidence and decision-making skills (Musset and Mytna Kurekova, 2018[32]).

Countries such as Germany, Ireland and Scotland have developed comprehensive career guidance services offering access at any point in life and a combination of digital tools for self-guided exploration and face-to-face services for higher levels of need. In Scotland, career guidance is recognised as a specialist profession, with a requirement for both initial and continuous professional training (Musset and Mytna Kurekova, 2018[32]).

To address the uncertainty of future skills needs, policies also need to make education and training systems more relevant to the labour market and more reactive to changes.

Work-based learning is critical to strengthening the links between the education system and the labour market. By providing workplace training, employers demonstrate their support for such programmes. Workplaces provide an environment conducive to developing skills needed in the labour market (OECD, 2015[33]).

In countries with strong apprenticeship systems, the need for specific policies to encourage provision of work-based learning depends on the costs and benefits of training for employers. In Germany, firms show a strong willingness to make net investments in apprenticeships, as 60% of apprentices remain in the firm after training. In Switzerland, by contrast, employers are less willing to make upfront investments, due to higher mobility of apprentices after training has ended. Firm size matters: investments in training are particularly challenging for small and medium enterprises, while retention rates are lower (Mühlemann, 2016[34]). This suggests that policy interventions may be warranted when labour market conditions limit employers' incentives to provide training, and in countries and sectors with large shares of small enterprises.

Several regions and countries also seek to encourage work-based learning in higher education. In Ontario (Canada), greater use of work-based training has been promoted through tax credits, better information about the support available to employers and the skills of students, and flexible work-time and supervision requirements. It is also important for higher education institutions to co-ordinate their approaches to employers, to avoid excessive or duplicative demands (Sattler and Peters, 2012[35]). In Portugal, making internships mandatory in some programmes was found to strengthen partnerships between higher education institutions and employers and to boost employability more than other forms of work-based learning. Further, several shorter internships can have a superior effect on employability than longer, single internships, by allowing students to explore different work functions and workplaces (Silva et al., 2016[36]).

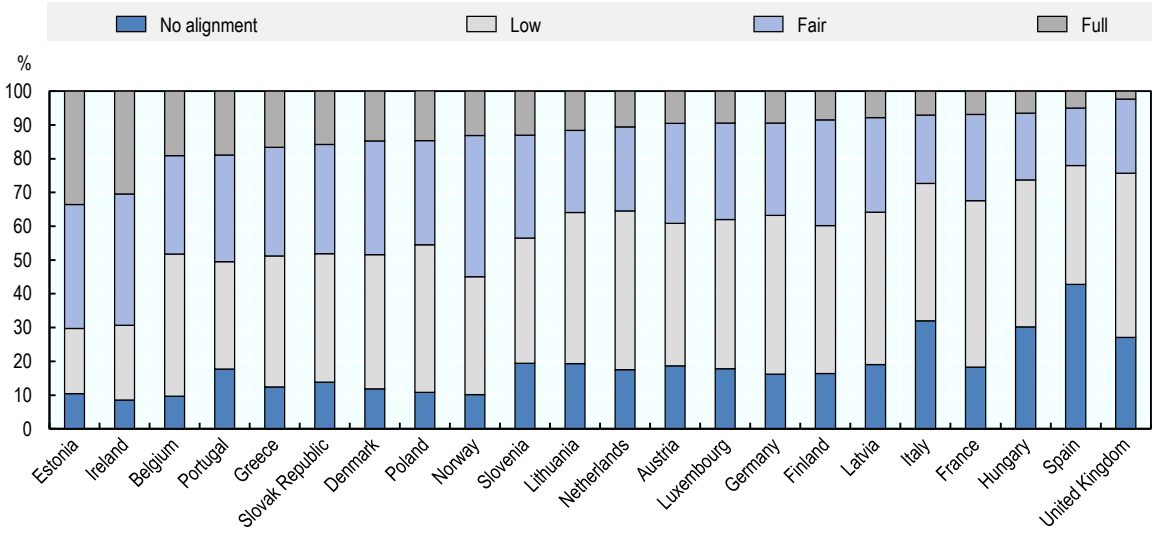
Fostering entrepreneurial skills through education and training is another way to prepare workers for non-linear career paths and help them seize the opportunities of the digital economy. As the gig economy continues to expand, entrepreneurial skills become increasingly required for workers who wish to provide their services through online platforms. In OECD countries, entrepreneurship education in universities largely focuses on business creation. However, embedding entrepreneurship education within research and teaching is seen as increasingly valuable to develop entrepreneurial competences such as creativity and risk-taking (Benneworth and Osborne, 2015[37]). In addition, policies that encourage a shift at all education levels towards a learner-centred approach to teaching can help provide key entrepreneurial skills (Penaluna and Penaluna, 2015[38]).

Training provided on the job also need to respond to the needs of firms and labour markets. Workers' training activities need to be aligned with the identified skill needs of the company (OECD, 2019[39]). When comparing the top three skills that firms report as important for the development of the firm with the three most important skills targeted in training activities, there is only a complete overlap for 13% of firms across European

OECD countries (Figure 6.6). This misalignment arises partly because some firms only provide compulsory training opportunities, such as health and safety training. This type of training should not substitute for training that help develop the skills workers need to face changes on the labour market.

Figure 6.6. Overlap between firms' development and training priorities

Percentage of firms at different degrees of alignment between the skills they consider as the most important for further firms' development and skills targeted through training, 2015



Note: Excludes firms with fewer than 10 employees. Countries are ranked by their average degree of alignment. The degree of alignment is calculated as the overlap between the top three development priorities of the firms and their top three training priorities (in terms of training hours). Each firm can score either zero (i.e. no overlap), low (i.e. one development priority is also a training priority), fair (i.e. two development priorities are also training priorities) or full alignment (i.e. complete overlap between development and training priorities).
Source: OECD (2019[39]), *Getting Skills Right: Future-Ready Adult Learning Systems*, https://dx.doi.org/10.1787/9789264311756-en.

StatLink http://dx.doi.org/10.1787/888933974729

Co-ordinating policies to offset the unequal geographic impact of digitalisation

The digital transformation can exacerbate inequalities between cities and regions. Access to the Internet varies between regions within countries. High-tech firms are concentrated in a small number of geographic areas where most job creation related to new technologies takes place while other areas have to face major job destruction. At the same time, digital technologies facilitate remote working and work practices that take advantage of ICT tools, thus making learning and job opportunities more ubiquitous.

Offsetting the unequal geographic impact of digitalisation is not easy. Many policies, including education and skills policies, tend to reinforce each other in exacerbating regional disparities unless they are well designed. The accumulation of disadvantages in some regions creates dissatisfaction and a sense of injustice among the population. This section discusses policies that can ensure the benefits of digitalisation are more equally shared within countries.

The benefits of digitalisation are shared unequally within countries

Digitalisation has affected regions and cities within countries unequally. Skills-related policies can influence this divide. The rate of convergence in economic prosperity between regions and cities within OECD countries has undergone a sharp slowdown since the 1980s. The advent of the personal computer and the many technologies it enabled has contributed to this slowdown. Other factors include the offshoring consequences of globalisation, declining labour mobility in some countries, and agglomeration economies (Box 6.1) (Rosés and Wolf, 2018[40]).

Box 6.1. Agglomeration economies: Why economic activity is so highly concentrated geographically

About three in four Americans live in cities, yet these cities span only 2% of the land area. Moreover, despite not needing any specific raw materials, software producers in the United States are highly concentrated in the area dubbed Silicon Valley, between San Francisco and San Jose (Rosenthal and Strange, 2004[41]).

The explanation lies in what are called agglomeration economies, or economies of scale generated by the concentration of factors of production in geographic space (Duranton and Puga, 2004[42]; Rosenthal and Strange, 2004[41]). Building on Alfred Marshall's (1890[43]) taxonomy, economists have distinguished three main mechanisms underlying agglomeration economies: sharing, matching, and learning (Duranton and Puga, 2004[42]).

Sharing: In densely populated areas, firms and workers can gain from having access to a wider range of input supplies due to the proximity to a large final goods industry as well as through the sharing of high fixed-costs indivisible goods and facilities such as sports stadiums, parks and airports.

Matching: The spatial concentration of firms and workers can improve the quality of the match between workers' skill supply and firms' skill demand as well as increase the probability of a match taking place since there are more workers and firms to choose from.

Learning: Workers in densely populated cities can benefit from the informal exchange of ideas, management practices and new technology uses with other workers which increases their productivity and promotes faster innovation. This mechanism implies there are economies of scale whose benefits accrue over time or dynamic agglomeration economies.

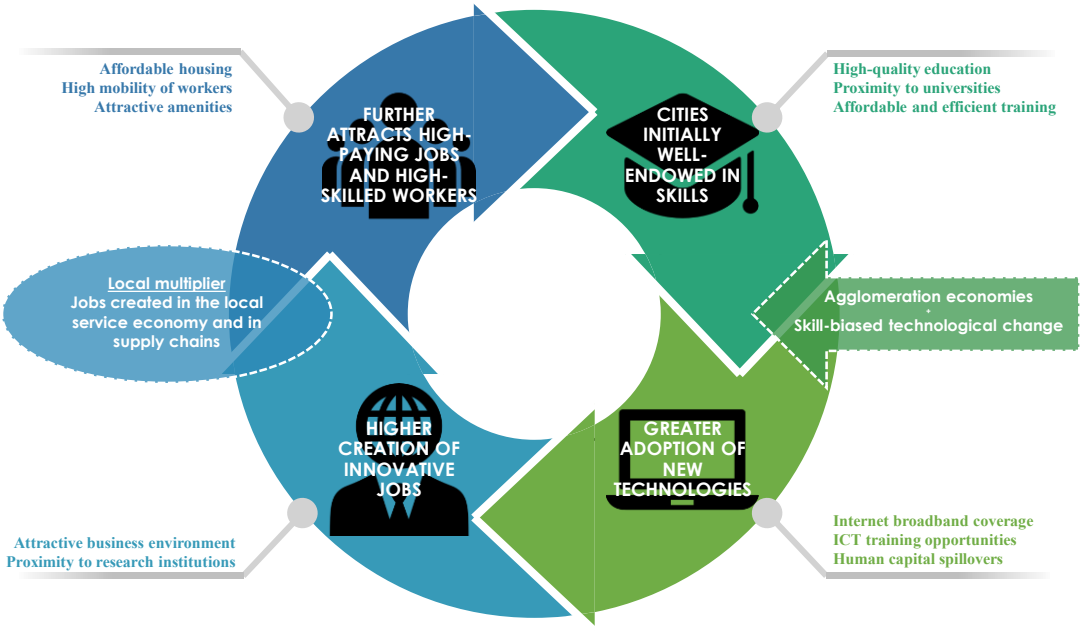
Sources: Rosenthal, S.S. and C. Strange (2004[41]), "Evidence on the nature and sources of agglomeration economies", http://dx.doi.org/10.1016/S0169-7218(04)07049-2; Duranton, G. and D. Puga (2004[42]), "Micro-foundations of urban agglomeration economies", http://dx.doi.org/10.1016/S0169-7218(04)07048-0; Marshall, A. (1890[43]), *Principles of Economics*, Macmillan, London.

In the United States, computer adoption and new computer-related jobs were more likely to be observed in the 1990s and 2000s in areas that already in the 1980s had a high stock of high-skilled workers (proxied by the share of college-educated workers) (Lin, 2011[44]; Berger and Frey, 2016[45]; Beaudry, Doms and Lewis, 2010[46]). The complementarity between technology and skills has enabled these areas to experience faster growth in income and skill endowment than less-skilled cities (Giannone, 2017[47]; Rosés and Wolf, 2018[40]).

At the same time as new technology-related jobs were being created in cities with highly skilled populations, old manufacturing hubs or areas poorly endowed in tertiary-educated individuals were falling behind. Although it may have seemed that the ubiquity of digital technologies would lessen geographic disparities, rendering physical proximity irrelevant, the opposite seems to have held so far. The benefits of digitalisation, reinforced by agglomeration economies, have been highly concentrated spatially, although there are signs that some firms are starting to take advantage of digital technologies to locate outside high-tech regions and escape high living costs (The Economist, 2018[48]).

High-skilled individuals attract technology-intensive firms and industries, and high-paying jobs, and high-paying jobs further attract high-skilled workers. Low-skilled jobs in the local service economy also grow to cater for the needs of these firms and workers. This virtuous cycle underpins much regional and urban success (Figure 6.7).

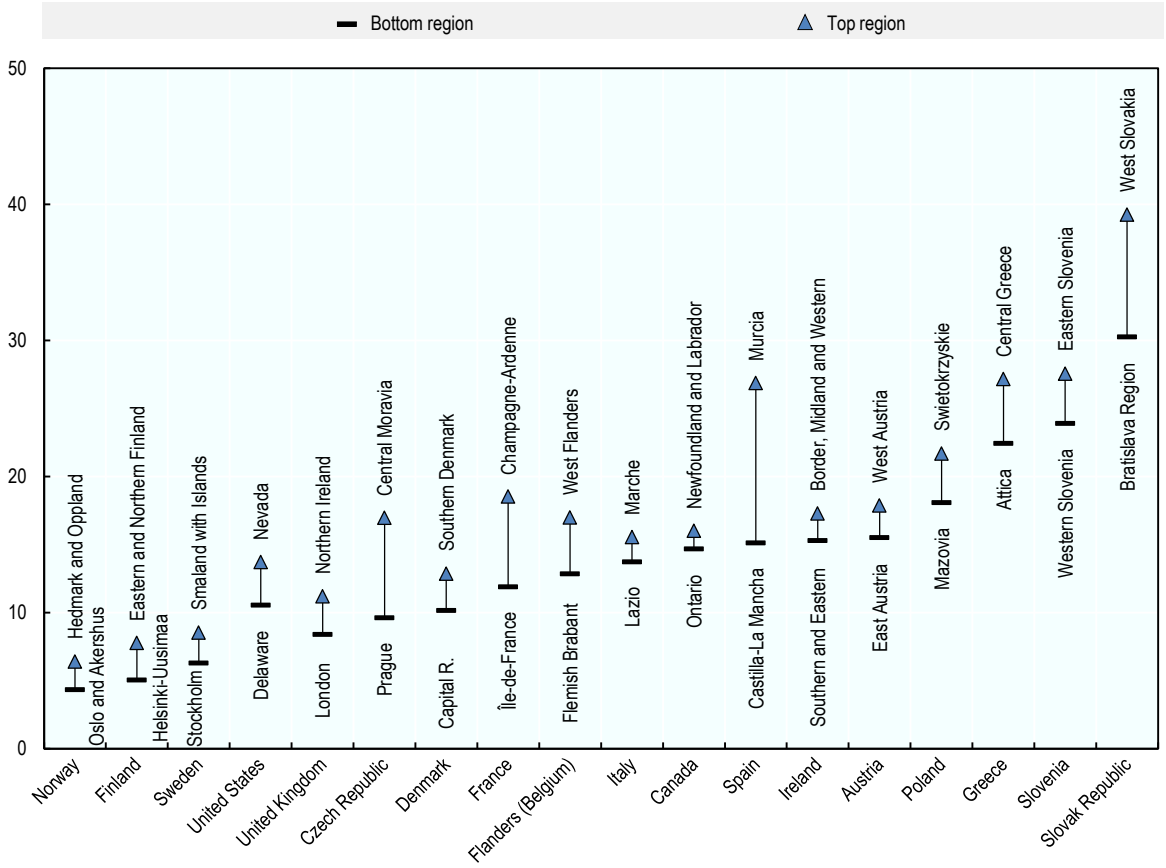
Figure 6.7 Mutually reinforcing beneficial local effects of skills and technology



In the future, automation may deepen regional inequalities as the number of jobs at high risk of automation varies significantly between regions within countries (Figure 6.8) (OECD, 2018[49]). Regions with the lowest share of tertiary-educated workers also have the highest share of jobs at high risk (OECD, 2018[49]). Given that less educated workers tend to be less geographically mobile, this phenomenon threatens to further aggravate inequalities between regions. Some regions will be characterised by high unemployment and low productivity while others will thrive, with high employment and productivity.

Figure 6.8. Share of jobs at high risk of automation within countries

Percentage of jobs at high risk of automation, highest and lowest performing TL2 regions, by country, 2016



Note: High risk of automation refers to the share of workers whose jobs face a risk of automation of 70% or above. Data from Germany corresponds to the year 2013. Except for Flanders (Belgium), for which subregions are considered (corresponding to NUTS2 level of the European Classification).
Source: OECD (2018[49]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en.

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Equalising children's education opportunities

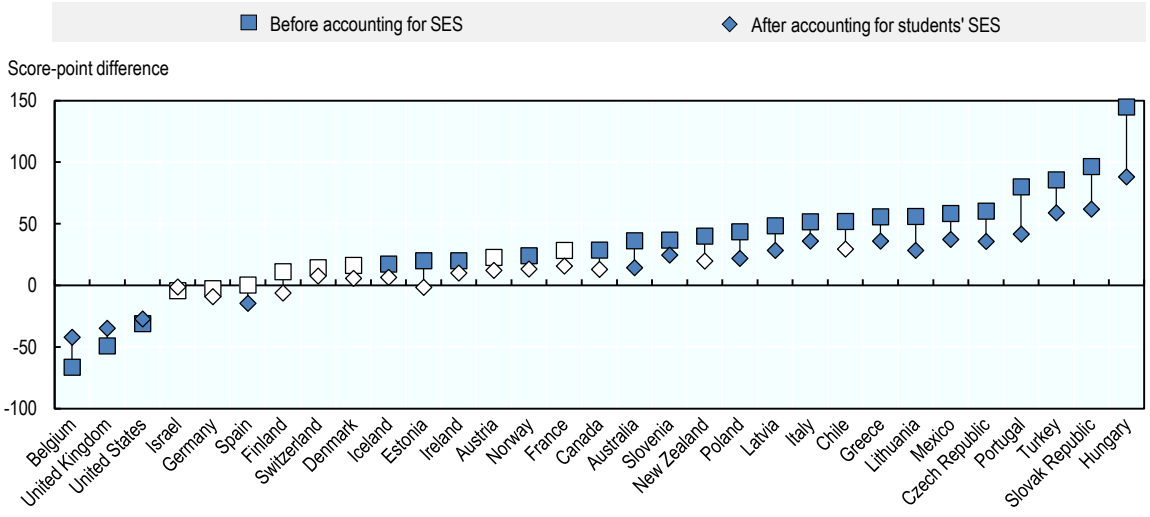
Human capital is a key driver of economic growth, both at the national (Barro, 1991[50]) and subnational levels (Gennaioli et al., 2013[51]). The emergence of the knowledge economy has heightened its importance. Inequities in the skills endowment of regions explain part of the differences in regions' economic performance. Thus an education system that is affordable, accessible and high-performing, at every age level, can help local economies that have been left behind to catch up by improving their skill endowments.

A better prepared workforce increases a region's economic performance and can help attract firms that offer job opportunities matching the local talent pool. It can also spur entrepreneurial activity. Skills also facilitate the adoption of new technologies and new management practices that boost workers' productivity (Andrews, Nicoletti and Timiliotis, 2018[52]). There are also significant non-monetary benefits from having a better skilled

workforce, including lower crime rates, lower health costs and greater social cohesion, which may together contribute to making an area more prosperous (OECD, 2010[53]).

In many OECD countries, students in cities (of over 100 000 people) score higher in science than their rural counterparts (in areas of less than 3 000 people), though the difference is not always statistically significant (Figure 6.9) A gap of 30 points, which corresponds to the average scores gap between urban and rural students in OECD countries, is the equivalent of roughly one academic year (OECD, 2018[54]). Results in reading and mathematics match these findings.

Figure 6.9 Rural-urban differences in students' performance (PISA 2015)



Note: These figures display, for each country, the average difference in PISA scores between 15-year-old students in rural and urban schools without any controls and accounting for the socio-economic status of the student. Statistically significant differences at the 5% are marked in a darker tone. Schools in rural area or village are defined as being located in "a village, hamlet or rural area with fewer than 3 000 people," while schools in cities are defined as being located in a city of over 100 000 people. A student's socio-economic status is estimated by the PISA index of economic, social and cultural status (ESCS), which is derived from several variables related to students' family background such as parents' education, parents' occupations, a number of home possessions that can be taken as proxies for material wealth, and the number of books and other educational resources available in the home (OECD, 2016, p. 205[55]).
Source: OECD (2015[56]), *PISA database 2015*, http://www.oecd.org/pisa/data/2015database/.

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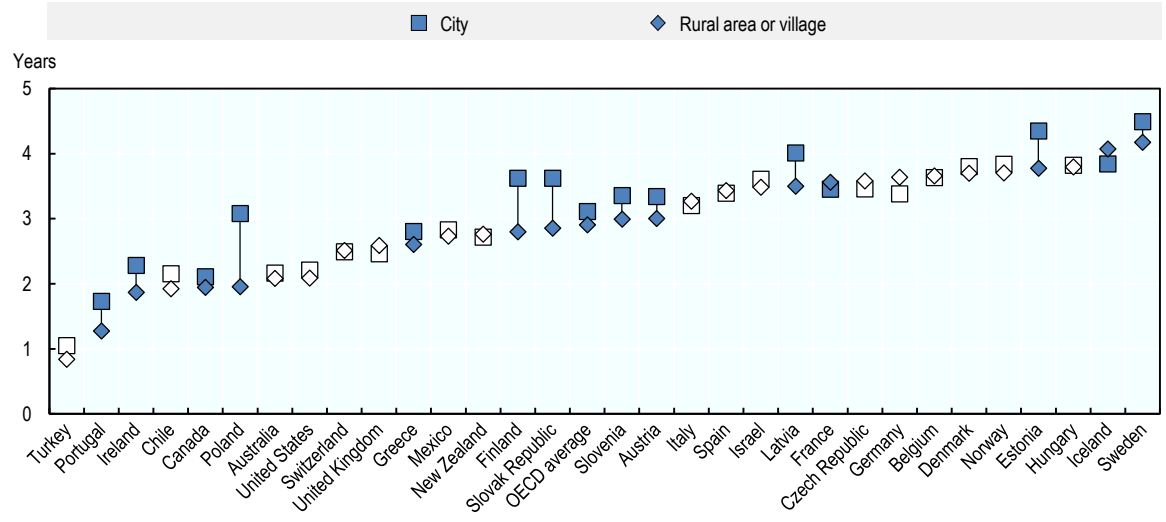
Students' socio-economic background does not explain all the difference in scores, suggesting that school characteristics and the local environment may also play a role. Schools in rural areas tend to have less responsibility for resource allocation; have a harder time recruiting, training and retaining teachers; are smaller in size and are less likely to have a high proportion of qualified teachers (OECD, 2018[54]). What happens outside schools in children's neighbourhoods also matters crucially for children's acquisition of cognitive and non-cognitive skills (Goux and Maurin, 2007[57]; Bell et al., 2017[58]). Narrowing these gaps would constitute a first step in equalising economic opportunities between regions within countries.

Policies

As children's early years are essential for the development of their cognitive and socio-emotional skills (Heckman, 2006[59]), pre-primary school can help even up opportunities between children from privileged and from disadvantaged backgrounds, as well as between those living in sparsely populated rural areas and those in thriving dense cities. Countries need to ensure that young children of all regions can attend high-quality pre-primary education.

The urban-rural gap in the number of years attending pre-primary school is significant in several OECD countries (Figure 6.10). On average across OECD countries, students attending a school in a rural area or village report having attended two months less of pre-primary school than their urban counterparts.

Figure 6.10. Average number of years attending pre-primary school, by school location



Note: This figure displays, for each country, the average number of years attending pre-primary school as self-reported by the 15-year-old students themselves between those currently in a rural or urban school. Statistically significant differences at the 5% are marked in a darker tone. Schools in rural area or village are defined as being located in "a village, hamlet or rural area with fewer than 3 000 people," while schools in cities are defined as being located in a city of over 100 000 people.
Source: OECD (2015[56]), *PISA database 2015*, http://www.oecd.org/pisa/data/2015database/, Table II.6.51.

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These recommendations do not apply just to rural areas that face specific challenges linked to their low population levels. Cities and regions as a whole should ensure that the education they provide equips their residents with at least basic cognitive and interpersonal capacities to improve their productivity and generate positive local spillovers. Many geographic divides are between growing and lagging-behind cities or between city centres and suburbs.

Incentives to motivate the best teachers to move to the least privileged schools can help bridge gaps between advantaged and disadvantaged schools. In many countries, however, including some that compensate for disadvantage in schools by allocating more teachers to those schools, teachers in the most disadvantaged schools are less qualified and/or

experienced than those in the most advantaged schools (OECD, 2018[60]). Combining the flexibility of recruitment and management that comes from greater school autonomy with compensatory funding mechanisms appears to enable the most challenging schools to attract the best teachers.

Harnessing the potential of universities

Universities can boost regional development (Drucker and Goldstein, 2007[61]; OECD, 2007[62]; Bonaccorsi, 2017[63]), though the magnitude of the effect crucially depends on the local context (Bonaccorsi, 2017[63]). Universities can increase the supply of skills, by educating individuals and attracting others from outside, and the demand for skilled workers, through research and development activities (Moretti, 2013[64]; Abel and Deitz, 2012[65]). The local return to higher education is significant, not only for the individual but also for the community. Skilled university graduates can attract firms with high-paying jobs, further attracting new high-skilled workers and thereby initiating a virtuous cycle described in Figure 6.7

Proximity to top academic experts is crucial for the innovative sector, even more so than proximity to venture capital firms or access to government funding (Zucker, Darby and Armstrong, 2002[66]; Zucker and Darby, 2014[67]). Private-sector start-ups in highly technical fields such as artificial intelligence, robotics or biotechnology need to stay up to date with the latest academic research and physical proximity facilitates this process. Academic stars are often personally involved in or leading such start-up ventures (Gideon, 2016[68]).

Universities can also improve individuals' geographic mobility. One study from the United States found that attending college had a causal impact on individuals' interstate migration (Malamud and Wozniak, 2012[69]). The mechanisms through which university attendance improves geographic mobility are unclear and may be related to the acquisition of general cognitive skills or the possibility to benefit from a more geographically dispersed labour market for university-acquired skills and degrees.

Using data from the 2014 European Tertiary Education Register (Box 6.2), it is possible to map the location of universities in some European countries. Higher education institutions are very unequally distributed within European countries (Figure 6.11). Because the size of the regions in the Nomenclature of Territorial Units for Statistics (NUTS 3) differs markedly between countries, comparisons are to be taken with some precautions. In the vast majority of these European countries, over a quarter of regions do not have any universities. Universities tend to be located in densely populated areas, particularly in capital cities such as Istanbul, Paris and Warsaw. Research-oriented universities – those delivering PhD-level degrees (ISCED 8) – which may offer the most potential for local growth, are even more highly concentrated.

Box 6.2. Geographic distribution of higher education institutions

The European Tertiary Education Register (ETER) is a European Commission initiative that collects information on higher education institutions (HEIs) in 35 European countries and Turkey. It provides data at the institution level on numerous dimensions such as basic administrative characteristics, geographic location and educational activities. The coverage is close to that of Eurostat for ISCED levels 6 (bachelor's degree), 7 (master's degree), and 8 (PhD) but limited at level 5 (short-cycle tertiary education) (Lepori et al., 2016[70]). Data from 2014 is used. The regional typology used in this analysis is the 2013 Nomenclature of Territorial Units for Statistics (NUTS) 3, which corresponds to small regions (*département* in France, *Kreis* in Germany).

There are two caveats for the analysis presented here. First, institutions in Luxembourg, Montenegro, Romania and Slovenia do not provide information on the highest degree they deliver, a variable used to identify PhD-granting (research) universities. Second, the way multi-site institutions are accounted for may lead to slightly underestimate university dispersion.

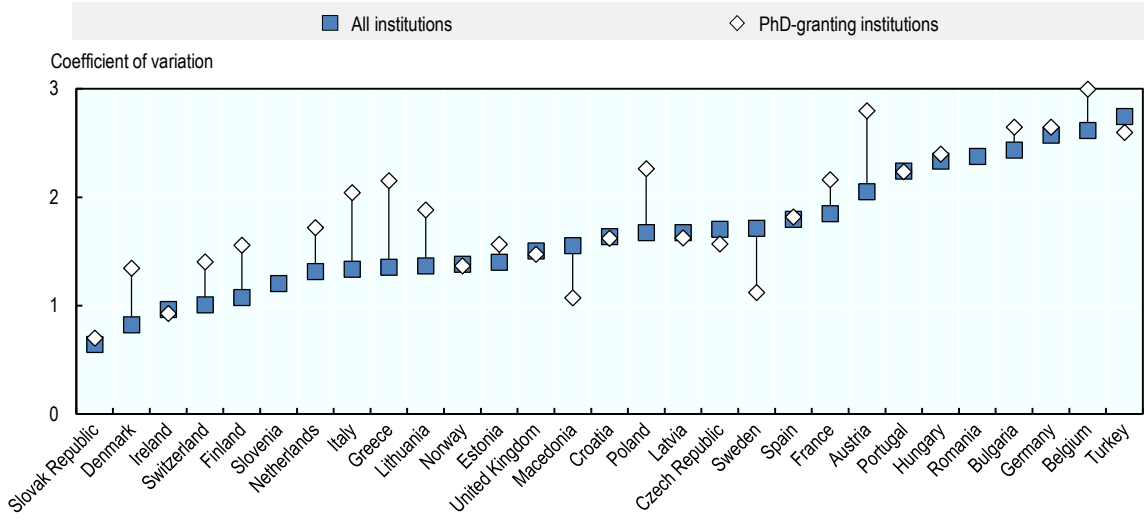
Source: Lepori, B. et al. (2016[70]), *The ETER Perimeter and Coverage: An In-depth Analysis*, https://www.eter-project.com/assets/pdf/ETER_perimeter_and_coverage.pdf (accessed on 29 August 2018).

The geographic dispersion of higher education institutions matters because distance to university is an important factor in shaping students' educational aspirations, as well as in the decision to attend university – and in particular an elite institution – though its role varies by country (Gibbons and Vignoles, 2012[71]; Parker et al., 2016[72]; Spiess and Wrohlich, 2010[73]; Frenette, 2006[74]). With the exception of Belgium, 15-year-old students in rural areas are significantly less likely to expect to complete a university degree than their urban counterparts (Figure 6.12). On average across OECD countries, children attending a school in a city of over 100 000 people are 19 percentage points more likely to expect to attend university than those attending a school in an area with less than 3 000 inhabitants.

This gap remains in a number of countries even after accounting for students' socio-economic status and maths proficiency, implying that environmental factors play a large role in shaping student expectations.

Figure 6.11. Dispersion of the number of higher education institutions (HEIs) and PhD-granting HEIs by country in 2014

Coefficient of variation of the number of institutions per NUTS 3 region within a country



Note: This figure displays, for each country, a measure of dispersion, the coefficient of variation (standard deviation divided by the mean), of the number of higher education institutions and PhD-granting institutions per NUTS 3 region within a country in 2014. The NUTS classification corresponds to that from 2013.
Source: ETER (2014[75]), European Tertiary Education Register, https://www.eter-project.com/#/home.

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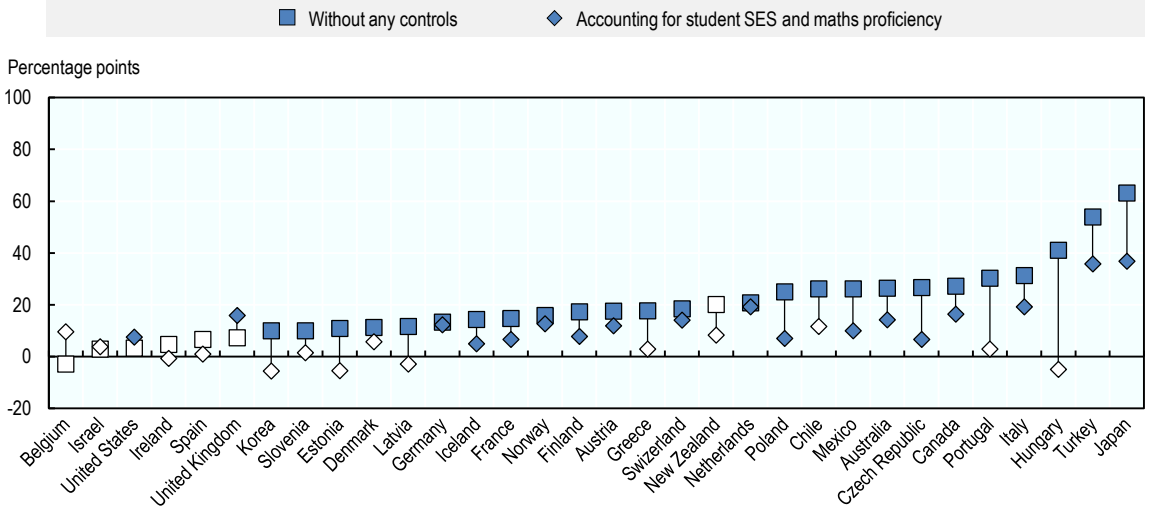
Figure 6.12 Difference between urban and rural schools in share of students expecting to complete a university degree



Note: This figure displays, for each country, the difference between urban and rural schools in the share of 15-year-old students expecting to complete a university degree, without any controls and accounting for student socio-economic status and maths proficiency. Statistically significant differences at the 5% are marked in a darker tone. Schools in rural area or village are defined as being located in "a village, hamlet or rural area with fewer than 3 000 people," while schools in cities are defined as being located in a city of over 100 000 people. A student's socio-economic status is defined as explained in Figure 6.9's note.
Source: OECD (2015[56]), *PISA database 2015*, http://www.oecd.org/pisa/data/2015database/.

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Policies

There are two main policy options to close this aspiration and attendance gap. First, to reduce the financial burden of attending an institution far from home, universities and public institutions could provide distance-based aid that would increase as a function of the prospective student's distance from the university (perhaps using precise expected travel time by train, bus or car rather than a simple radial distance). Information about this aid should be clearly advertised, with teachers communicating the specific details to students. Open education and open universities that provide options to enrol in tertiary programmes from remote areas can also bridge the aspiration and attendance gap between geographic areas (Chapter 4).

Second, role model, mentoring and outreach programmes by university students may help raise the aspirations of students who lack exposure to universities because of their schools' remoteness. Schools in areas far from any higher education institution could, for example, organise regular discussions between their students and former students who attended university. Other forms of mentoring programmes could conversely finance school trips to universities, where secondary students would be able to visit the campus, talk with current students and perhaps meet professors or attend classes.

Enabling geographic mobility

Increasing workers' ability to move from one geographical area to another can play a key role in lessening the differences in regional performance brought about by digitalisation. Enabling individuals to move from low-income to high-income areas increases labour supply in the high-income area and puts downward pressure on wages. In the medium run, this decreases income gaps between the two areas. The decline in such migration from low- to high-income areas in the United States may have contributed to the slowdown in regional convergence (Ganong and Shoag, 2017[76]).

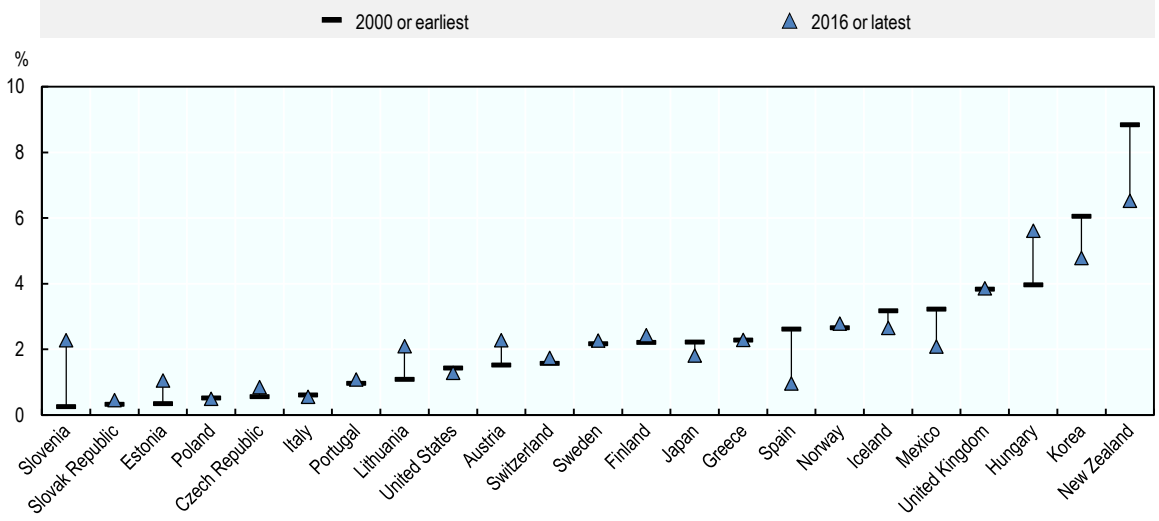
In some OECD countries, workers' geographical mobility has declined in recent decades (Figure 6.13). This phenomenon is particularly pronounced in Korea, Mexico, New Zealand and Spain. Even the United States, which is often thought of as a very mobile country, has experienced a slight decline in migration. There are many reasons why individuals do not move within and between countries. They have social ties where they currently live, there is uncertainty as to whether they will find a job if they move, and housing costs have reached very high levels in many booming areas. In addition, the industrial composition of areas has become more homogenous, reducing the need to move, and the Internet has enabled individuals to acquire information about potential new locations without having to live in a different place for some time (Kaplan and Schulhofer-Wohl, 2017[77]).

Improving coverage of digital infrastructures

The extent of access to broadband Internet varies significantly between regions within countries (Figure 6.14). On average across OECD countries, around four out of every five households had broadband Internet access at home in 2016. In Denmark, Iceland and Korea, the difference between the best and worst performing TL2 (large) region is less than 5 percentage points while it is above or close to 50 percentage points in Mexico, Russia and Turkey. Statistics computed at this large regional level may also hide significant disparities within regions.

Figure 6.13 Geographical labour mobility in 2000 and 2015

Percentage of individuals moving, within the same country, to another TL3 (small) region



Note: This figure displays the percentage of individuals, within a given country, that relocated to another TL3 (small) region in 2000 (or early 2000s) and in 2016 (or latest available). For each country, the years used are as follows: Slovenia: 2000-16; Slovak Republic: 2000-16; Estonia: 2000-15; Poland: 2000-16; Czech Republic: 2000-16; Italy: 2002-13; Portugal: 2001-11; Lithuania: 2001-15; United States: 2000-11; Austria: 2002-16; Switzerland: 2000-16; Sweden: 2000-16; Finland: 2000-16; Japan: 2000-16; Greece: 2001-11; Spain: 2000-16; Norway: 2000-16; Iceland: 2000-16; Mexico: 2000-15; United Kingdom: 2000-15; Hungary: 2000-16; Korea: 2000-16; New Zealand: 2001-13.
Source: OECD (2016[78]), *OECD Regional Database*, https://stats.oecd.org/Index.aspx?DataSetCode=REGION_DEMOGR#.

StatLink http://dx.doi.org/10.1787/888933974843

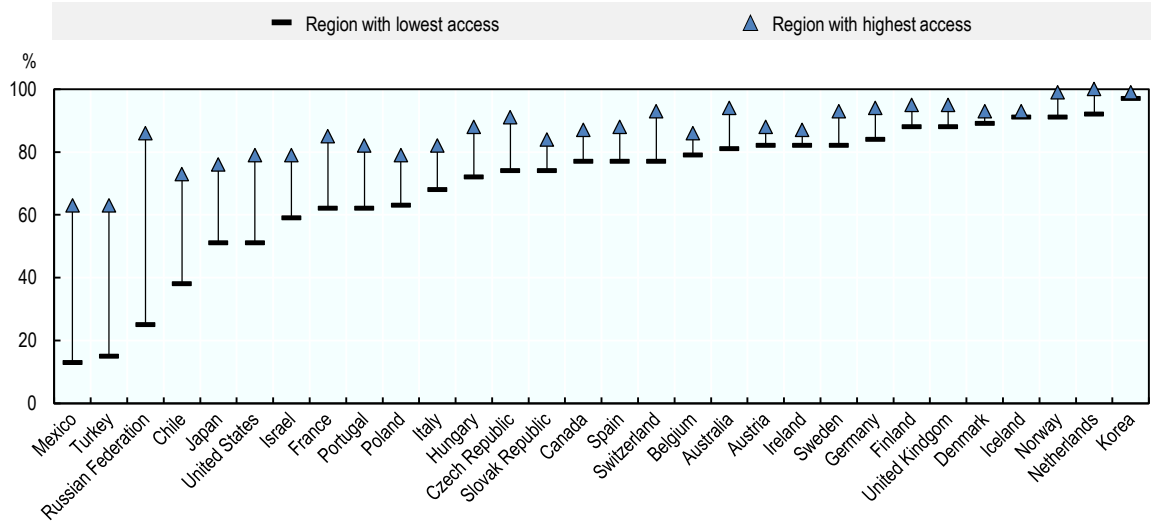
A priori, the reasons for such stark differences within countries in access to broadband Internet are not obvious. Such differences could be due to a lack of demand, (people not needing or wishing to have Internet access) inadequate supply (insufficient coverage of rural areas, as is often the case), or unaffordable Internet service prices. The fact that rural areas are still underserved by broadband Internet suggests that many countries can still improve the supply of Internet access throughout their territories.

Access to broadband Internet is essential for people and firms in many respects. It enables people to communicate with their friends and families, to shop online, to look for jobs or training opportunities, to access government services, to book medical appointments, to monitor bank accounts, and to keep up to date with current affairs and any other interests they may have (Chapter 4). It helps people of all ages acquire the digital skills that are crucial to navigate through the digital age. As for firms, it seems unthinkable today for a firm to establish itself in an area without or even moderately slow Internet access.

Moreover, firms' access to high-speed broadband Internet is a key enabler for the adoption of more advanced digital technologies such as cloud computing and sophisticated front and back office software that may increase productivity (Andrews, Nicoletti and Timiliotis, 2018[52]). It is thus crucial for regional convergence that national and regional broadband access policies prioritise full territorial coverage.

Figure 6.14. Regional differences in access to broadband Internet

Percent of households with Internet broadband access, by country, 2016



Note: The figure displays, for each country, the percentage of households with internet broadband access in the worst and best performing TL2 (large) region in 2016. Data is from 2016 for Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary Ireland, Italy, the Netherlands, Norway, Portugal, Slovak Republic, Spain and Sweden; 2015 for Australia, Japan, Mexico and Russian Federation; 2014 for Korea, Israel, Poland and Switzerland; 2013 for Chile, Turkey and the United Kingdom; 2012 for Canada and Iceland; and 2011 for the United States.

Source: OECD (2016[79]), *OECD Regional Database, Regional Social and Environmental Indicators*, https://stats.oecd.org/Index.aspx?DataSetCode=REGION_SOCIAL.

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A co-ordinated policy response across policy areas and actors

Making the most of digitalisation requires a co-ordinated policy response across policy areas and actors. While education and skills policies are central in the response to the challenges brought by the digital transformation, other major policy areas also have an important role to play. Social protection, for instance, influences people's capacity to improve their skills, change career when needed and feel protected against labour market risks. Close alignment and interactions between various policy areas are important.

Identifying the range of relevant policies

The development of new technologies can stimulate countries' innovation, growth and productivity while offering people new economic and social opportunities. These opportunities are diverse. They include access to cheaper products and services for people and firms, new activities facilitated by online platforms, new and flexible work arrangements and business models, renting out real estate directly among individuals, and creating communities and interest groups that can translate into political impact.

A range of policies affect countries' and regions' capacities to make the most of digitalisation. Ensuring that policies and institutions facilitate and encourage lifelong learning for all is the cornerstone of the whole policy package. As discussed earlier in this chapter, strong lifelong learning systems in themselves require a combination of targeted policies to support broad participation in a high-quality and equitable range of education and training options.

Policies outside the skills domain also affect the extent and speed of the digital transformation, the demand for jobs and skills, and thereby the implications of the digital transformation for the labour market, productivity, and inequality. That means policies in various domains need to be co-ordinated to make the most of the digital transformation.

For instance, the explosion of economic and social activity online requires protection for the safety, privacy and security of online users, while ensuring that the benefits of online economic activity is broadly and fairly shared. Policies that help people to develop the skills and knowledge they need to protect themselves against new risks need to be co-ordinated with policies that affect the spread of online economic and social activity.

Intangibles such as software and data are highly mobile and firms can now disconnect their central location from where their users/customers and suppliers are located. These changes generate opportunities for firms in the digital technology sector to quickly reach "scale without mass", and monopoly or oligopoly situations. As a result, governments can find it difficult to use social, labour and tax policies to spread the benefits of digitalisation (OECD, 2015[80]).

Digitalisation also challenges governments' ability to maintain trust in democratic institutions and public services. The digital transformation is rapid and brings a multiplicity of players with diverse views into the economic, social and cultural realm. Institutional and policy responses, by contrast, are slower, and sometimes involve limited and uneven human attention (OECD, 2017[81]; Williams, 2018[82]). This gap underlines the importance of designing and co-ordinating policies well so that they can manage the various impacts of digitalisation and respond to rapid change by being well connected to the needs of citizens in a digital world.

Policies

In response to the digital transformation, the large majority of OECD countries have developed comprehensive national digital strategies, agendas or programmes with a series of objectives across several policy areas. In an OECD survey on the topic, countries' three top objectives were identified as: strengthening e-government services, further developing telecommunications infrastructure, and promoting ICT-related skills and competences (OECD, 2017[81]).

Countries need multi-dimensional policies that take advantage of the opportunities of digitalisation, mitigate its risks, or do both simultaneously (Table 6.1). Lifelong learning policies play a central role in that they are often a building block for other policies. For instance, accelerating digital adoption in firms to improve growth and productivity requires good skills among firm managers and employees. Lifelong learning can also help cushion the disruptive effects of digitalisation. It can provide access to high-quality learning opportunities for adults who are unemployed or at risk of displacement, facilitate access to employment, and limit reliance on social protection.

Innovation lies at the heart of the digital economy. Policies aimed at boosting innovation can play an important role in funding long-term research that firms are reluctant to invest in due to the scale of investment needed, the risk involved, or the risk that the resulting assets may be broadly available (non-excludable) (OECD, 2017[83]). Innovation policies can also focus on closing the divides in technology use and creation between OECD and emerging countries, between regions within countries, between younger and older people, and between women and men. Some of these policies include expanding digital infrastructure to ensure accessibility for all. Access alone is not sufficient, however. These policies need to be complemented by education and skills measures, aimed for instance at raising the proportion of women graduating from science-related fields and entering the labour market.

Favourable business policies are critical to ensure technology is adopted broadly. Ensuring access to capital, flexible employment protection legislation and high levels of competition (e.g. by lowering administrative burdens on start-ups so they can compete with established firms), can support workers' mobility and risk-taking by firms, which in turn can promote the adoption and diffusion of digital technologies. As outlined in other chapters, policies that encourage the development and use of skills also form an important lever for the adoption of technology (Andrews, Nicoletti and Timiliotis, 2018[52]).

Labour market policies play a key role in countries' capacities to make the most of digital transformation, as they influence not only innovation and technology adoption but also skills development and use. Flexible employment protection legislation (EPL) can facilitate labour market restructuring and the adoption of new technologies. A large share of temporary contracts and high labour market mobility can be less conducive to innovation, however, which requires time and stable teams.

At the same time, EPL affects how much training employers provide. Recent evidence from Finland and Italy suggests that a higher reliance on temporary contracts diminishes employer-sponsored training (Bolli and Kemper, 2015[84]; Bratti, Conti and Sulis, 2018[85]). The digital transformation may further promote the diffusion of non-standard forms of work, which may reduce job security for some workers and limit access to training. Countries need to reassess their labour market policies to take into account the range of implications of the digital transformation on labour markets.

Several countries seek to boost their competitive edge in the technology sector by attracting highly skilled migrants to alleviate labour shortages or build human capital. France, Israel and Korea have all recently introduced "tech" visas with expedited procedures (OECD, 2018[86]). To ensure highly skilled migrants can contribute to the host country's skills pool, policies need to align the migration system with longer-term economic development policies as well as immediate labour needs, and put systems in place that assess and recognise qualifications and skills (Papademetriou, Somerville and Tanaka, 2008[87]).

Economic development policies at national, regional and local levels play an important role in realising the potential of digitalisation. Such policies need to be multifaceted. They include developing the business environment, boosting education and skills and infrastructure, and developing regions' competitive advantages through clusters that combine economic activity with research, development and innovation in key sectors. Policies that boost international trade and investment are also vital (OECD, 2018[88]). Co-ordinating economic development policies with education and skills policies is crucial to ensure the right levels and types of skills are available to meet economic needs at national, regional and local levels. An insufficient supply of skilled workers can limit a country's or region's ability to build strong competitive advantages in global value chains, while insufficient demand for skills can spur outward migration to other regions or countries.

Tax policies can play various roles in the digital economy. First, they influence the incentives of individuals and firms to work and hire, and the incentives of both to invest in skills. For instance, in systems where a high portion of increased earnings expected to result from training are taxed away, incentives to increase skills may be lower. Motivations for increasing skills are broader, however, and can depend on other policies, such as social and labour market policies. As a result, it is vital to co-ordinate education and training policies with tax, social and labour market policies.

Second, a key role of tax systems is to lower the gap between market income and disposable income through redistribution. However, the digital transformation may amplify existing skills disparities within socio-economic, gender and age groups, as some groups are less likely to retrain, learn about new skills in need, and make informed career choices. These increased skills disparities may translate into higher wage inequalities, making it more costly to correct market income inequalities through tax policies (OECD, 2017[89]; Berger and Frey, 2016[45]). Thus, investing in skills, especially to provide high quality education to all, is needed not only to achieve inclusive growth but also to ensure that tax policies are effective.

Social protection policies, along with taxation, are a major policy instrument to help workers move smoothly between jobs or deal with job displacement or unemployment spells. They can also prevent new forms of work from pushing workers into lower-quality jobs. The rise of the platform economy obliges governments to identify the best ways to provide opportunities for workers to improve their skills, as well as sufficient protection for vulnerable workers who may not have access to health or retirement benefits. In addition, policies should make social security entitlements portable so that workers do not lose benefit entitlements when they move between jobs. Re-thinking social protection systems also requires a co-ordinated approach, to ensure social benefits are combined with effective tax systems and labour market policies, and open and flexible lifelong learning systems.

Housing and transport policies are critical to facilitate workers' mobility and their access to work opportunities, and thereby prevent the digital transformation from exacerbating geographical inequalities.

Table 6.1 Policies for digitalisation

Policies	Relevance: Does the policy promote the benefits of digitalisation, address risks, or both?		What are connections and complementarities between policies?	What stakeholders are most affected by these policies and should be engaged by government?
	Promotes benefits	Mitigates risks		
Digital infrastructure, innovation, technology adoption (in firms and government)	X		Changes demand for skills in all sectors (private sector, government and public services) Requires adapting to new forms of firms and work (scale without mass, no footprint)	Firms Particular focus on SMEs who lag behind in digital technology adoption
Business environment, competition (ease of entry and exit), access to capital	X		Changes demand for skills Accelerates innovation and take-up of technology	Firms Particular focus on firms in sectors with high barriers to entry, e.g. low access to capital
Migration policies	X		Supplements national skills supply Fosters digital technology adoption, innovation, business creation, regional and local development	Employer associations Unions
Lifelong learning (education and skills), managerial quality	X	X	Increases supply and demand of skilled workers to the labour market, accelerates adoption of digital technology and innovation, creation of businesses, attractiveness of country for foreign investment, regional and local economic development Increases tax revenues Can lower need for social protection	Firms Unions Education and training providers Employment and social services to reach low-skilled

Labour market policies and institutions	X	X	Flexible policies facilitate mobility of workers matching of skills to jobs, and in turn improve economic development, digital technology adoption, innovation and business creation, and increase tax revenues Can increase skills investments by employers and engagement in lifelong learning of individuals Can lower need for social protection	Firms Unions Education and training providers Employment and social services to reach low-skilled
Economic development and industrial policy (at all levels: foreign investment in countries, regional & local development)	X	X	Increases demand for skills and improves opportunity for labour-market relevant skills development opportunities locally Increases digital technology adoption, innovation, business creation Can increase tax revenues Can lower need for social protection	Firms Employer associations Education and training providers Employment and social services
Tax policies	X	X	Can stimulate skills investments, investments in technology, innovation and business creation Complement social protection via redistribution mechanisms	Firms Unions
Housing and transport	X	X	Facilitates worker mobility and better allocation to jobs; can lower need for social protection	Firms Unions
Social protection		X	Supports return to labour market, lifelong learning and upskilling if well connected with these policy areas	Firms Unions Representative of workers in the gig-economy not covered by unions

Sources: Based on information from OECD (2017[81]), *OECD Science, Technology and Industry Scoreboard 2017: The Digital Transformation*, https://doi.org/10.1787/9789264268821-en (accessed on 02 August 2018); Andrews, D., G. Nicoletti and C. Timiliotis (2018[52]), "Digital technology diffusion: A matter of capabilities, incentives or both?", http://dx.doi.org/10.1787/7c542c16-en; OECD (n.d.[90]), *OECD Skills Strategy 2019: Skills to shape a better future*, https://doi.org/10.1787/9789264313835-en.

Policy complementarity and whole-of-government co-ordination

Given the linkages between various policies necessary to make the most of digitalisation, countries need to co-ordinate the implementation of policy "packages" to ensure these have mutually reinforcing effects. Without co-ordination, there is a risk that policies fail to deliver results. This risk has been demonstrated by evidence that technological innovation does not lead to increased productivity if other policies are not in place, such as labour market policies, education and skills policies and a conducive legal framework (Acemoglu and Zilibotti, 2001[91]; Andrews, Nicoletti and Timiliotis, 2018[52]).

The geographical dimension of the digital transformation reflects a myriad of dynamics that can be influenced by policies at the national and local levels. In addition, a good understanding of the local context is often crucial to ensure the effectiveness of interventions (Rodríguez-Pose and Wilkie, 2017[92]). Actors at all levels need to co-ordinate policymaking across a wide range of areas, including education, housing, mobility, innovation, taxation and transportation. This co-ordination should focus on how each policy domain can mutually reinforce the effects of other domains in order to maximise the impact on regional development.

Policies

Along with significant public investments, governments are taking various approaches to co-ordinating complex policy packages. One key strategy consists of setting up governance structures responsible for monitoring the integrated design and co-ordinated implementation of multi-faceted strategies, such as national digital agendas.

The governance mechanisms used by countries are diverse (Table 6.2). Despite the high importance of the digital agenda and the breadth of policies that need to be involved, in most OECD countries national digital strategies are developed by a single ministry or body that is not located within the centre of government, and other ministries are mostly included solely for the implementation of policies. Such arrangements may hinder countries' abilities to co-ordinate and align policies, and make the most of the digital transformation.

Table 6.2. Governance of national digital strategies

	Lead the development	Contribute input	Co-ordinate	Implement	Monitor
Government, e.g. Prime Minister's Office, Presidency, Chancellery, Ministerial Council	4	0	5	1	6
Digital affairs ministry or body or ministerial position	8	1	10	3	8
Ministry or body not dedicated to digital affairs	15	2	13	1	11
Several ministries, bodies or institutions	6	14	5	26	7
Multiple public and private stakeholders	1	17	0	3	0

Source: OECD (2017[81]), *OECD Digital Economy Outlook 2017*, http://dx.doi.org/10.1787/9789264276284-en.

Another, often complementary, approach consists in establishing clear indicators of performance to measure the success of the digital strategy. Across the OECD, commonly used indicators include expanding broadband infrastructure; improving e-government and services; raising the use of Internet, online services, and digital technologies; increasing e-commerce and digitalisation of businesses' and improving citizens' skills in ICT and more broadly (OECD, 2017[81]). While these indicators are broad, they may not fully capture the whole range of areas that would need to be integrated into such strategies.

Only a few countries – Austria, Luxembourg, Mexico and the Slovak Republic – reported having as the lead for their national digital strategies a single high-level government official, e.g. in the Prime Minister's Office, Presidency or Chancellery, or a ministry or body dedicated to digital affairs. In Luxembourg and Mexico, the leadership of government in integrating a digital perspective in different policy areas has led to positive results, ranging from greater coverage of digital infrastructure to the improved use of digital technologies by citizens. Denmark has introduced a Disruption Council chaired by the prime minister, following its tradition of discussing transversal policy issues through commissions gathering the government, experts, employers and employees' organisations (Box 6.3).

Finally, implementing multi-faceted reforms requires taking into account the political economy of factors that can support or hinder the success of reform. This includes carefully analysing and planning the reform (which often involves significant time), engaging stakeholders while showing cohesive government leadership, and explaining to everyone involved the benefits of reform and the cost of not changing the status quo (Tompson, 2009[93]).

Box 6.3. Co-ordinating policies in the digital age

Created in 2014, **Digital Luxembourg** is an initiative that involves ministries, researchers, innovators and companies, and reports directly to the prime minister. Digital Luxembourg identifies needs and co-ordinates support for digital innovation. It offers support through financial investment, endorsement of projects, and a web platform and outreach activities that raise awareness about digital initiatives in the country.

The initiative supports progress in five priority areas: (i) improving skills, with projects such as coding in schools or women in tech, (ii) developing a digital ecosystem, with a EUR 20 million digital tech fund investing in a range of areas, from ICT startups to digital security, (iii) policy, with a focus on open data and privacy regulations, (iv) e-government, and (v) digital infrastructure, including broadband, free wifi, artificial intelligence and blockchain projects.

Luxembourg is among the top performers in the European Union's Digital Economy and Society Index (DESI). It ranks highly in human capital, in particular the use of digital skills and the Internet. Since its creation, Digital Luxembourg has enabled projects ranging from machine-readable legislation to new skills training opportunities.

Mexico's National Digital Strategy was created in 2013 and is led by the Co-ordination of the National Digital Strategy (NDS), an entity within the Executive Office of the president. The strategy aims to spur the development and adoption of digital technologies as part of achieving the goals of Mexico's National Development Plan.

The NDS focuses on: (i) government transformation, (ii) the digital economy, to boost innovation and productivity, (iii) education and skills, (iv) expanding access and quality of health services, and (v) civic innovation and citizen participation. Key policy initiatives focus on digital infrastructure, developing and using digital skills, the interoperability of government services, improving the legal framework governing the use of ICTs, and promoting open data.

Mexico has made notable progress towards a digital society. The 2017 OECD OUR (Open, Useful, Reusable) data index places Mexico at 5th place, after Korea, France, Japan and the United Kingdom, up from 10th in 2014.

In 2017, the **Danish government** established a **Disruption Council** to analyse, debate and present proposals for how Denmark should take advantage of the opportunities that technology brings. The council is chaired by the prime minister and includes several relevant ministers, as well as companies, trade unions, business leaders, entrepreneurs, experts and representatives from the rest of society. The council has already discussed and provided input to a tripartite agreement on a stronger and more flexible system for continuing training. In addition, the council contributed to the Danish government's digital strategy, which was launched in January 2018.

Sources: Digital Luxembourg (2018[94]), *Progress Report. Spring 2018*, https://digital-luxembourg.public.lu/sites/default/files/2018-06/DL_201804022_PROGRESS%20REPORT_08%20BAT.pdf (accessed on 03 August 2018); European Commission (2018[95]), *Digital Economy and Society Index 2018, Country Report Luxembourg*, https://ec.europa.eu/digital-single- (accessed on 03 August 2018); Coordination of the National Digital Strategy (2016[96]), *Mexico: The National Digital Strategy. An Action Plan for a Digital Country, Background Paper*, https://www.intgovforum.org/cms/igf2016/uploads/open_forum_background_paper/Mexico_Open_Forum.pdf (accessed on 03 August 2018); OECD (2018[97]), *Open Government Data in Mexico: The Way Forward*, https://doi.org/10.1787/9789264297944-en (accessed on 03 August 2018); Danish Ministry of Employment (2017[98]), *Disruptionrådet*, https://bm.dk/arbejdsomraader/aktuelle-fokusomraader/disruptionraadet/ (accessed on 28 August 2018).

Summary

This chapter considers two important objectives of policies intended to make the most of the digital transformation: 1) they need to foster lifelong learning, which is critical for workers and citizens adapt to changing world of work and societies, and 2) they need to facilitate mutually reinforcing local beneficial effects of skills and technology. If policies fail to achieve these objectives, the digital transformation may increase inequalities between individuals. Inequalities in learning opportunities often start in early childhood education, fuelled by differences in socio-economic background and the places people live. These inequalities are reinforced in schools and higher education, and continue into the labour market, where low-skilled workers have fewer opportunities to train and face greater risk of losing their jobs, especially in regions where industries are exposed to automation and few high-tech firms are creating jobs.

A well co-ordinated package of policies, centred on education and skills measures, is needed to foster lifelong and country-wide learning and more generally to ensure the digital transformation improves lives and livelihoods for all. A significant policy effort is required because of the range of policies that need to be better co-ordinated, the need to put in place structures and mechanisms to support this effort and the complexity of the inter-relations between policy areas.

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